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ENVIRONMENTAL RELATIONSHIPS OF BENTHOS IN SALT PONDS (PLANT RELATIONSHIPS). VOLUME 2

Rhode Island University

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Graduate School of Oceanography

University of Rhode Island

Kingston, Rhode Island

VOL. 2 of 2

ENVIRONMENTAL RELATIONSHIPS OF BENTHOS
IN SALT PONDS

(PLANT RELATIONSHIPS)

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66

FORWARD TO THE APPENDIX

This second volume is a companion to Volume I. of Technical Report No. 3, of Environmental Relationships of Benthos in Salt Pond. With the exception of the Ground Water flow data, provided by the U. S. Geological Survey, Boston Office, and meteorological data obtained from the U. S. Weather Bureau and the Point Judith Life Boat Station of the U. S. Coast Guard Service, all data included here are original. These data are presented in their present form for use by colleagues in need of definitive estuarine data for a number of important parameters of the environment.

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FIGURE A-1

The points indicated as stations on this map were selected for purposes of obtaining representative sampling points for water analysis, standing crops of plants, and sediments. Additional stations were occupied for sediment analysis and organic carbon content as indicated by Dillon in Volume II. Each station represents an area of the pond and ecological consequences related to it. Later in the survey some stations were omitted from the sampling program. The reader has been referred to this map from the legend describing the frequency polygon projections used in this study. The three axes suggested in the plan of the frequency polygons can be readily visualized as the three major arms of the estuary with the breachway and the open sound representing the "root" for each of these axes.

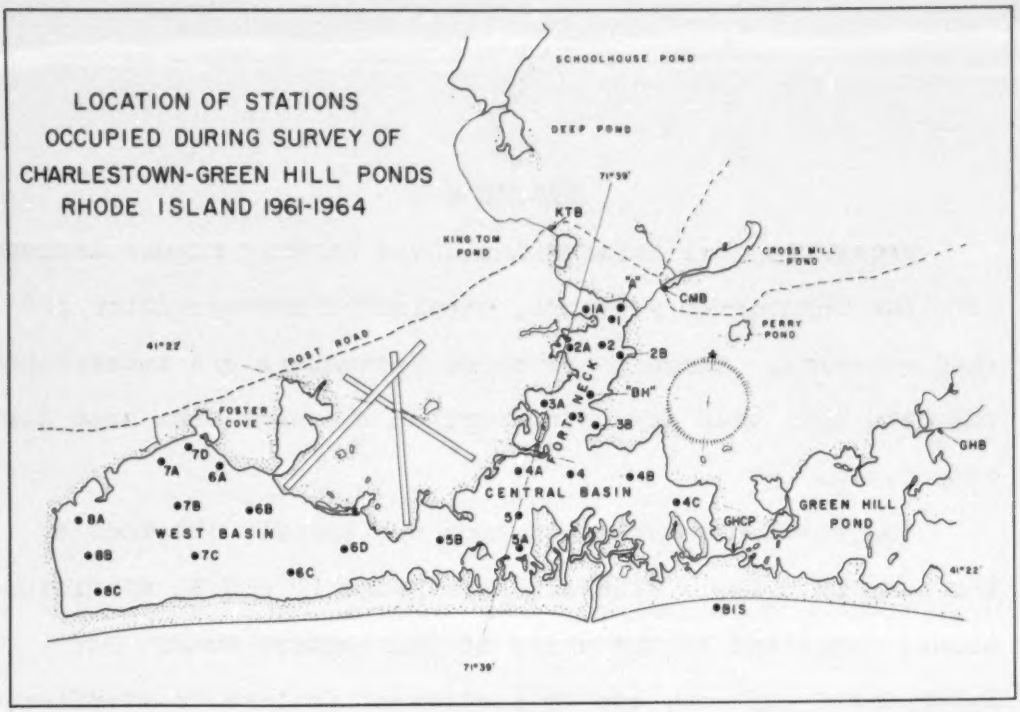

LOCATION OF STATIONS
OCCUPIED DURING SURVEY OF
CHARLESTOWN-GREEN HILL PONDS
RHODE ISLAND 1961-1964
SCHOOLHOUSE POND
DEEP POND
71°39'
KTB
KING TOM POND
CROSS MILL POND
CMB
PERRY POND
41°22'
POST ROAD
FOSTER COVE
"BH"
GHB
CENTRAL BASIN
WEST BASIN
GREEN HILL POND
GHCP
BIS
71°39'

FIGURE A-2

Meteorological information shown in this figure include data for barometric pressure, cumulative precipitation and wind velocity. Since these three parameters are interelated, the data have been presented here on the same time base for comparison.

The cumulative precipitation was largely obtained by the authors using a standard rain gauge (U.S.W.B. specifications) installed at the shore of Charlestown Pond. For interrupted periods, due to instrument failure or overflow, data were obtained from the U. S. Weather Bureau Station at Hillsgrove Municipal Airport near Providence, Rhode Island. Precipitation tended to be slightly greater at the Hillsgrove station. Wind velocity and barometric pressure data were kindly provided by the staff of the Point Judith Life Boat Station (U.S.C.G.), six miles east of Charlestown Pond.

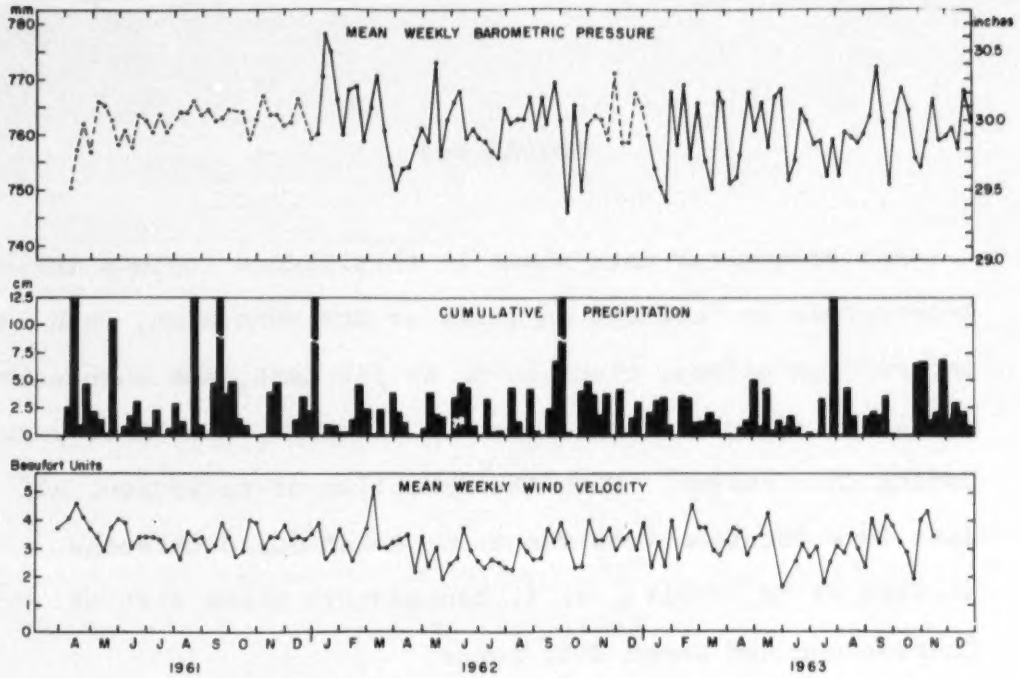

mm
780
770
760
750
740
MEAN WEEKLY BAROMETRIC PRESSURE
inches
305
300
295
290
cm
12.5
10.0
7.5
5.0
2.5
0
CUMULATIVE PRECIPITATION
Beaufort Units
5
4
3
2
1
0
MEAN WEEKLY WIND VELOCITY
A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1961
1962
1963

FIGURE A-3

Meteorological data shown in this figure include the air temperature in ^{o}celseus in terms of the mean high, mean low and average values, cloud cover in per cent, and cumulative radiation in gram calories per $cm.^{2}$ per day for three years during this survey. With the exception of radiation, all data were obtained from the U. S. Coast Guard Lifeboat Station at Pt. Judith, R. I. located six miles east of Charlestown and Green Hill Ponds.

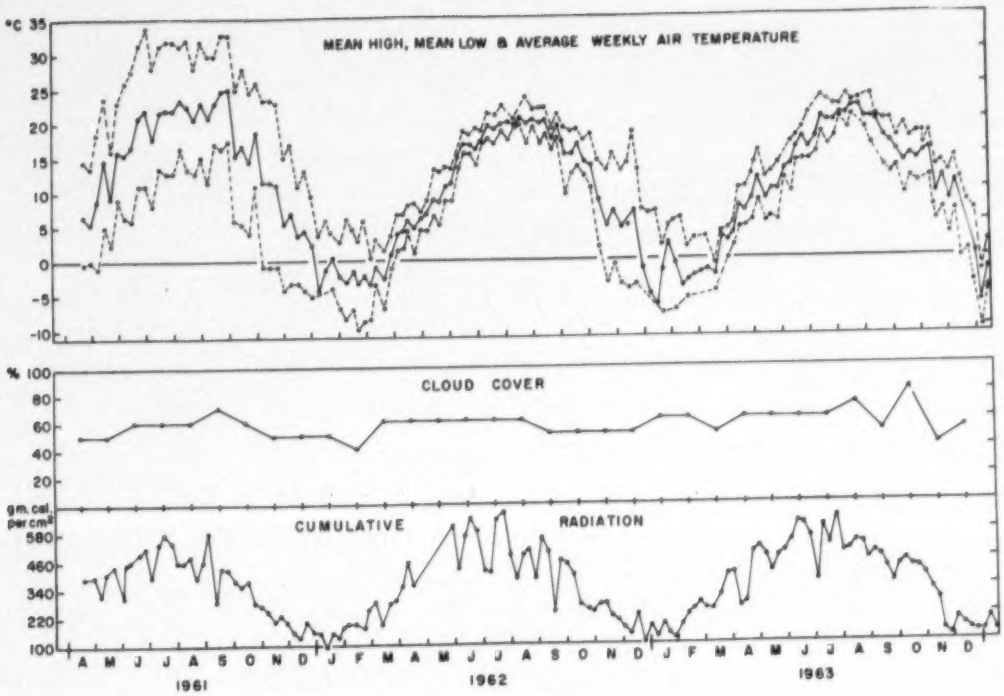
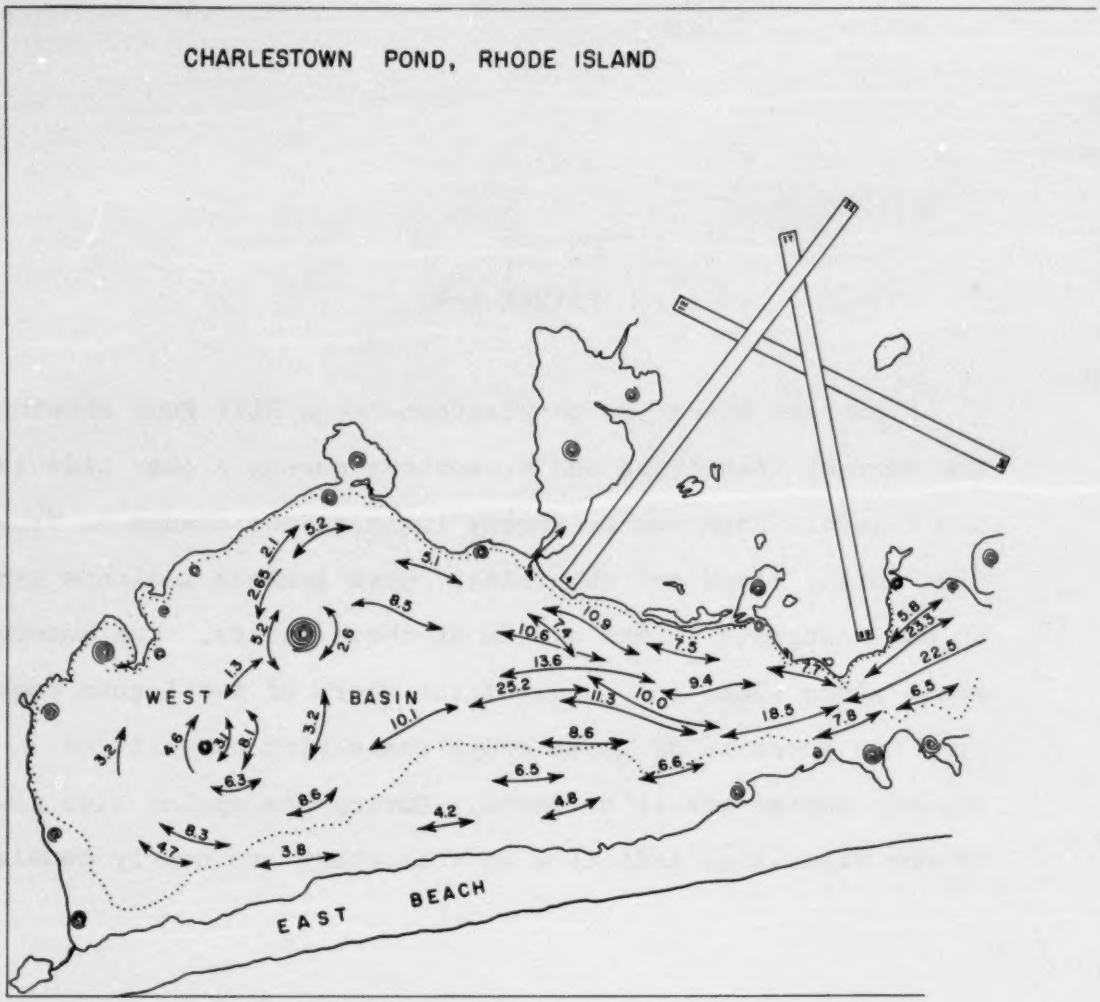

°C 35
30
25
20
15
10
5
0
-5
-10
MEAN HIGH, MEAN LOW & AVERAGE WEEKLY AIR TEMPERATURE
% 100
80
60
40
20
CLOUD COVER
gm. cal. per cm²
580
460
340
220
100
CUMULATIVE RADIATION
A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1961
1962
1963

FIGURE A-4

A current chart for Charlestown-Green Hill Pond showing the current velocities and directions during a neap tide in the lagoon. Note double arrows indicate the change in direction during flood and ebb tides. Gyre symbols indicate gyre or eddy currents in the system at those points. The numerous small gyres along the edges of the shore of the lagoon represent the location of those eddys where rich deposits of organic matter are to be found. During the spring tide most of the velocities indicated in this chart are nearly doubled.


CHARLESTOWN POND, RHODE ISLAND
WEST BASIN
EAST BEACH
5.2
2.1
2.63
5.1
8.5
5.2
2.6
1.3
3.2
4.6
3.1
8.1
3.2
10.1
6.3
8.6
8.3
4.7
3.8
4.2
6.5
4.8
8.6
6.6
10.6
7.4
10.9
7.5
13.6
25.2
11.3
10.0
9.4
7.7
18.5
7.8
6.5
5.8
23.3
22.5

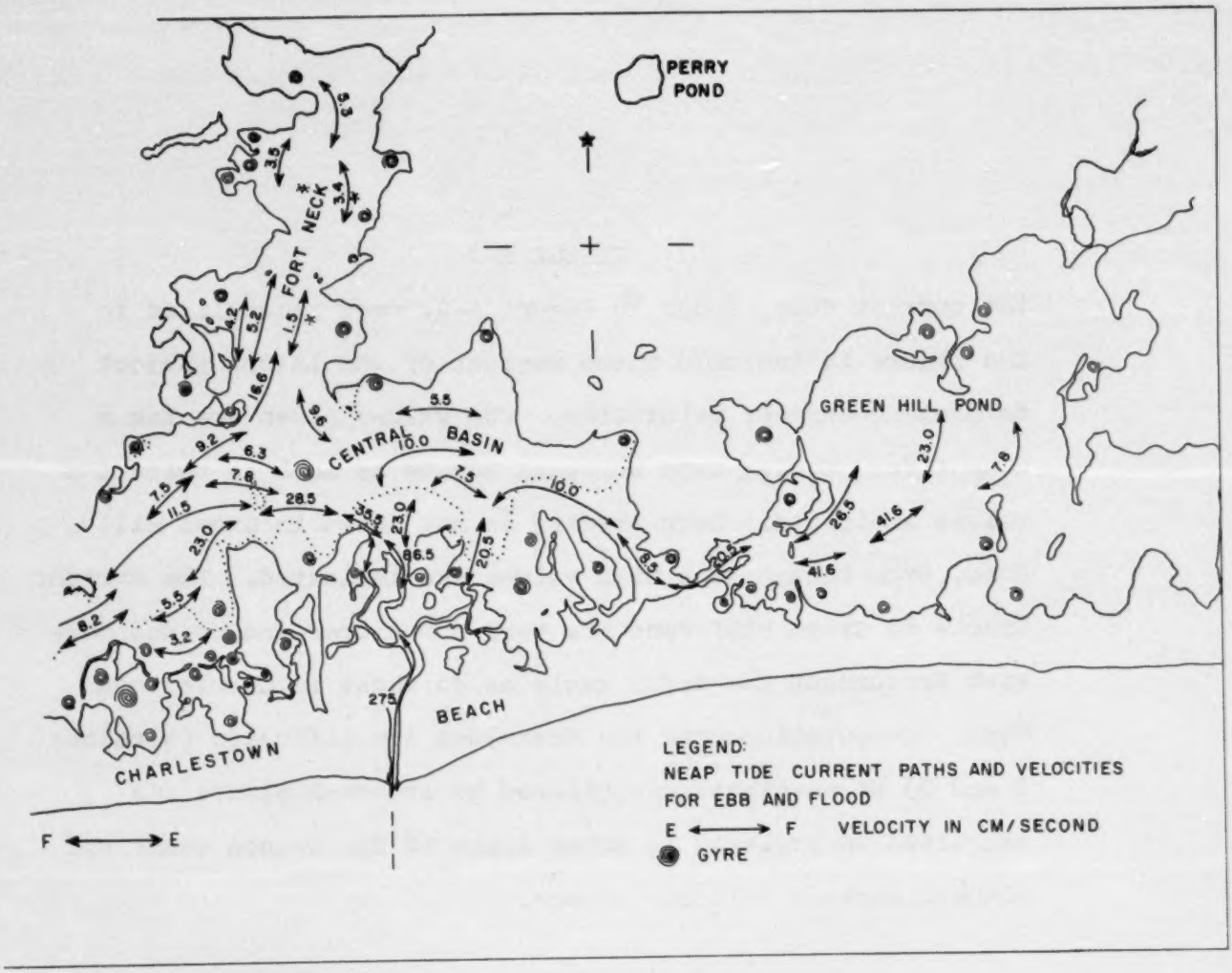

PERRY POND
FORT NECK
CENTRAL BASIN
GREEN HILL POND
BEACH
CHARLESTOWN
F ⟷ E
LEGEND:
NEAP TIDE CURRENT PATHS AND VELOCITIES FOR EBB AND FLOOD
E ⟷ F VELOCITY IN CM/SECOND
GYRE

FIGURE A-5

The current data, shown in Figure A-4, were generalized in the figure to indicate those regions of the lagoon subject to maximum current velocities. The values given are for a neap tide. Spring tide currents may be as much as twice the values indicated. Dark shading is not shown in Green Hill Pond, even though some high values are indicated. The current tracks in Green Hill Pond are very restricted and do not persist throughout the tidal cycle as do those in Charlestown Pond. Computations for the transport and diffusion (sections 3 and 5) of nutrients assimilated by attached plants are escalated accordingly in those areas of the lagoon where the highest current velocity occurs.

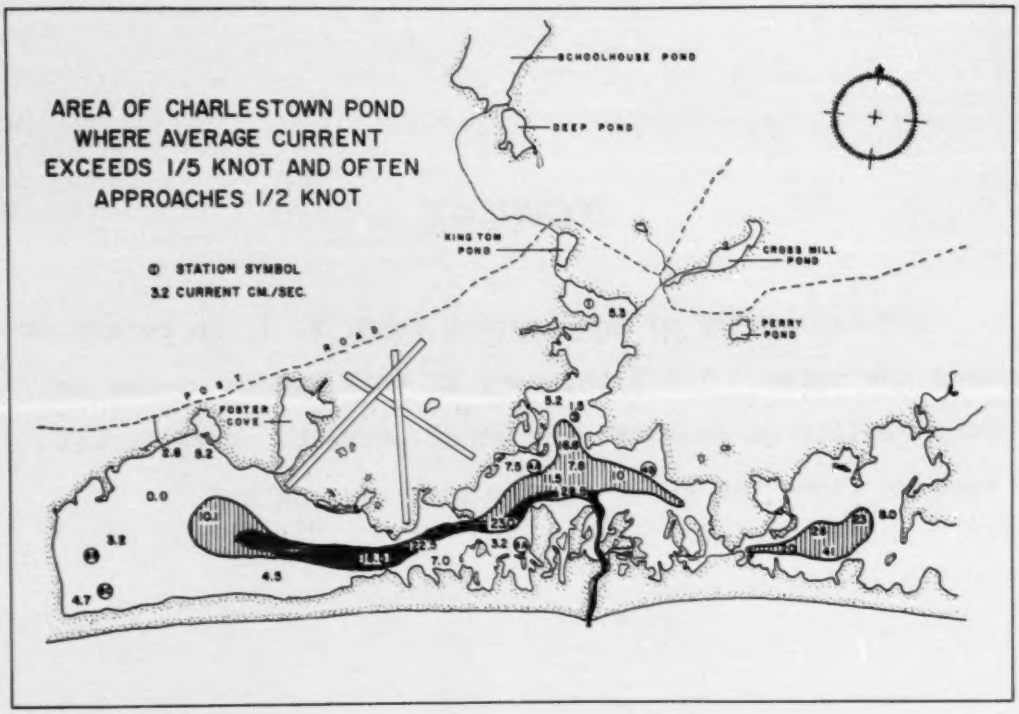

AREA OF CHARLESTOWN POND
WHERE AVERAGE CURRENT
EXCEEDS 1/5 KNOT AND OFTEN
APPROACHES 1/2 KNOT
⊙ STATION SYMBOL
3.2 CURRENT CM./SEC.
SCHOOLHOUSE POND
DEEP POND
KING TOM POND
CROSS HILL POND
PERRY POND
FOSTER COVE
POST
ROAD
DAM

FIGURE A-6

The bathimetry of Charlestown Pond, R. I. in meters at mean low water. The bathymetry of this lagoon system is very similar to that of many other outwash, post-glacial lagoons along the coast of southern New England.

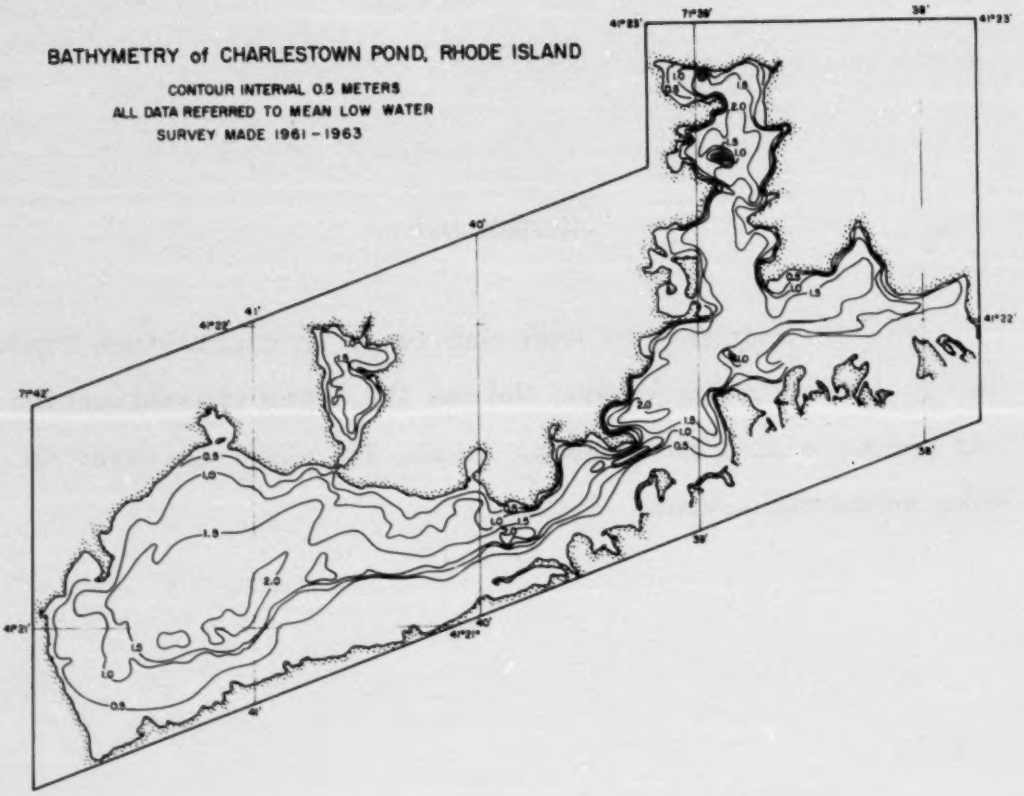
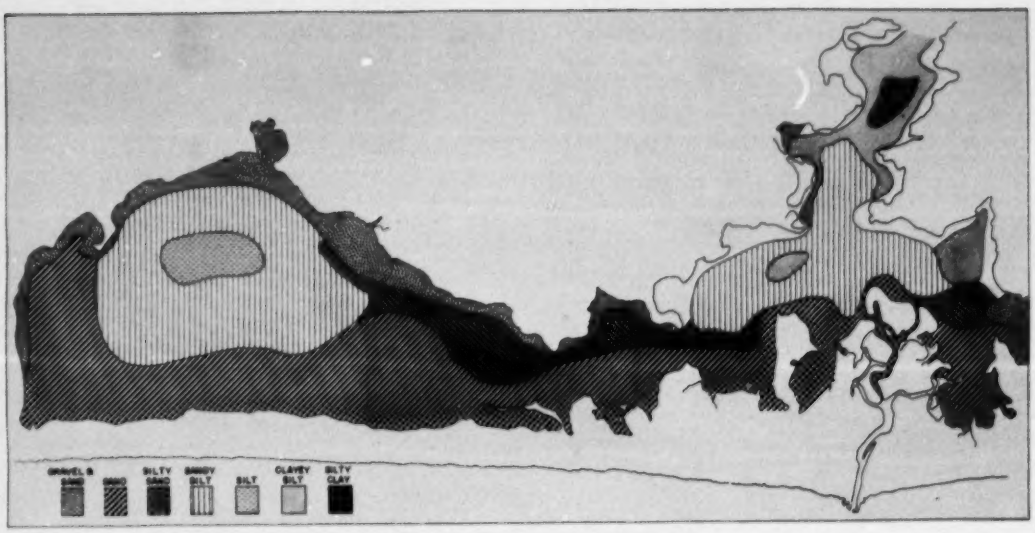

BATHYMETRY of CHARLESTOWN POND, RHODE ISLAND
CONTOUR INTERVAL 0.5 METERS
ALL DATA REFERRED TO MEAN LOW WATER
SURVEY MADE 1961 - 1963
41°23'
7°39'
38'
41°22'
40'
41'
7°42'
41°21'
39'

FIGURE A-7

The distribution of sediment types in Charlestown Pond, R. I. (after Dillon, 1964, Volume II). The classification of particle size into sands, silts, and clays is based on the Wentworth system.

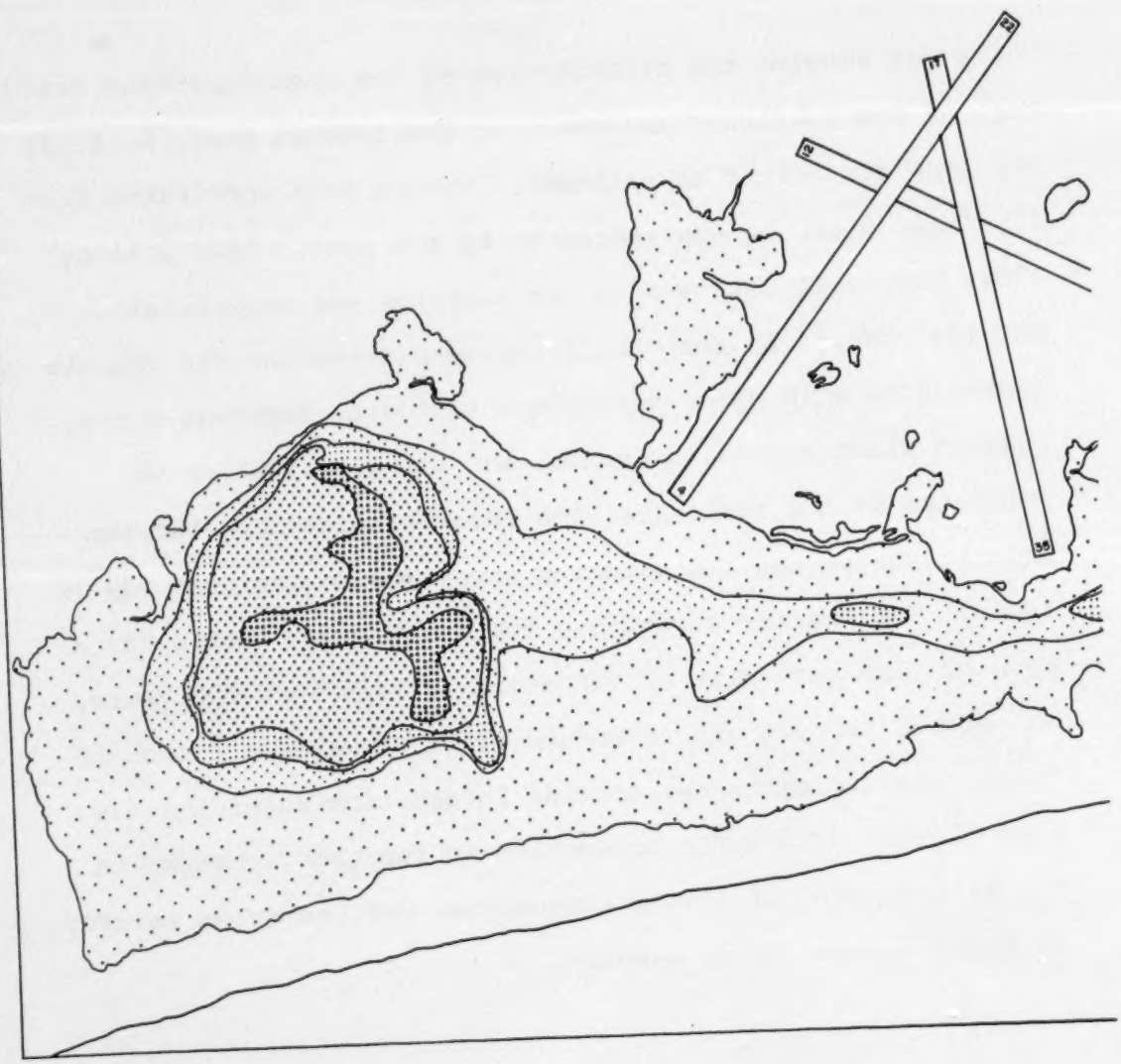


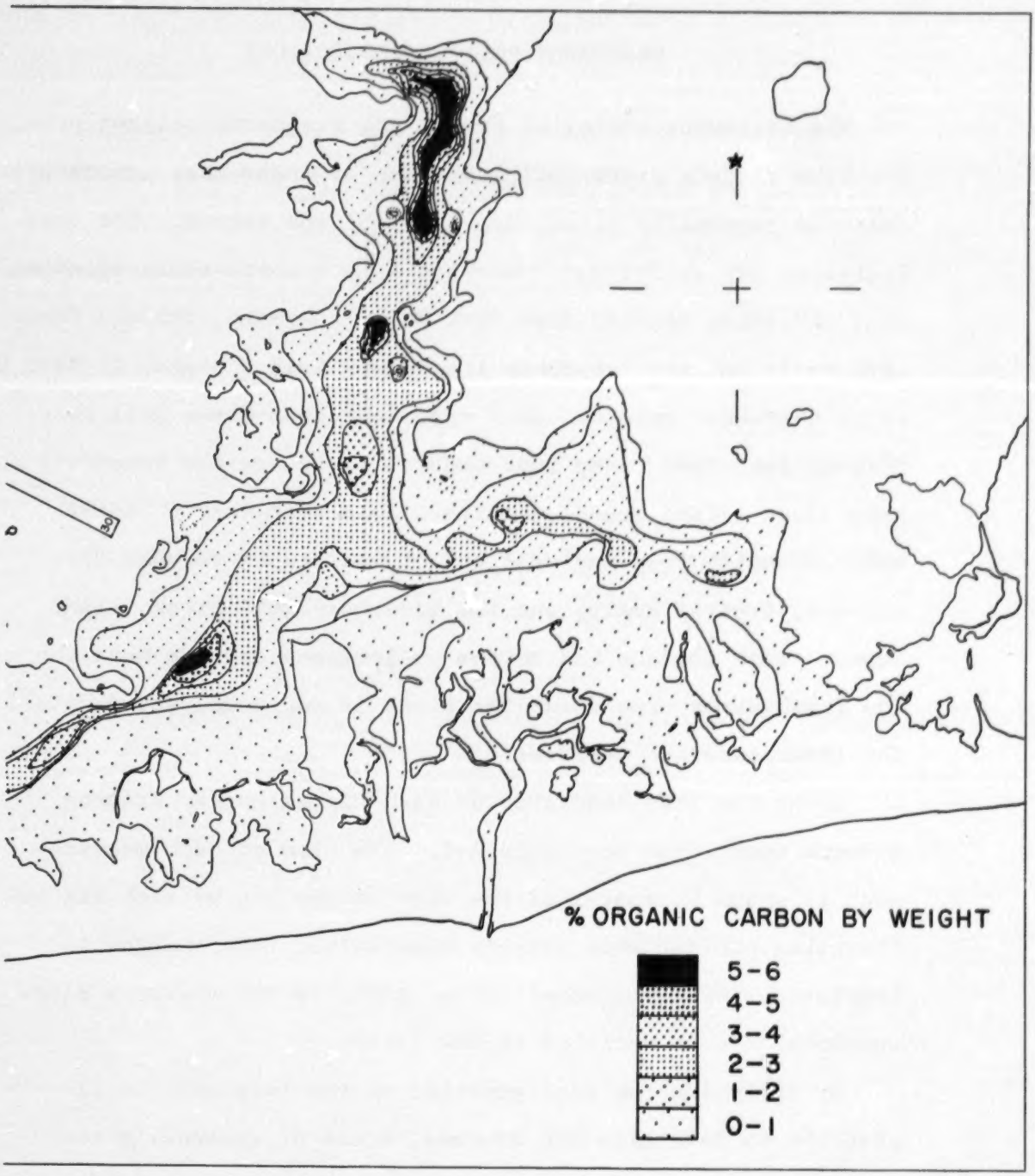
CHARLESTOWN POND - GENERALIZED SEDIMENT DISTRIBUTION

FIGURE A-8

A map showing the distribution of the organic carbon content of the surficial sediments of Charlestown Pond, R. I. as per cent dry weight of sediment. Carbon data were taken from the first 5 cm. of the sediments in the pond. (See Dillon, 1964, Volume II this series for sampling and analytical methods used.) By graphically cross-referencing the organic carbon data with other parameters including sediment types, benthic plant growth, currents, and the distribution of nutrients in the sediments, the interrelationships between organic carbon and the existing processes in the pond may be drawn. The organic carbon may represent accumulation for a span of time exceeding 50 but probably less than 100 years. Therefore, the pattern of accumulation of organic carbon in the bottom sediments may provide information regarding the past history of organic production in the pond, changes in the distribution of living communities and processes related to bioproduction in an estuary.

CHARLESTOWN POND, RHODE ISLAND




% ORGANIC CARBON BY WEIGHT
5-6
4-5
3-4
2-3
1-2
0-1

FREQUENCY POLYGON PROJECTIONS

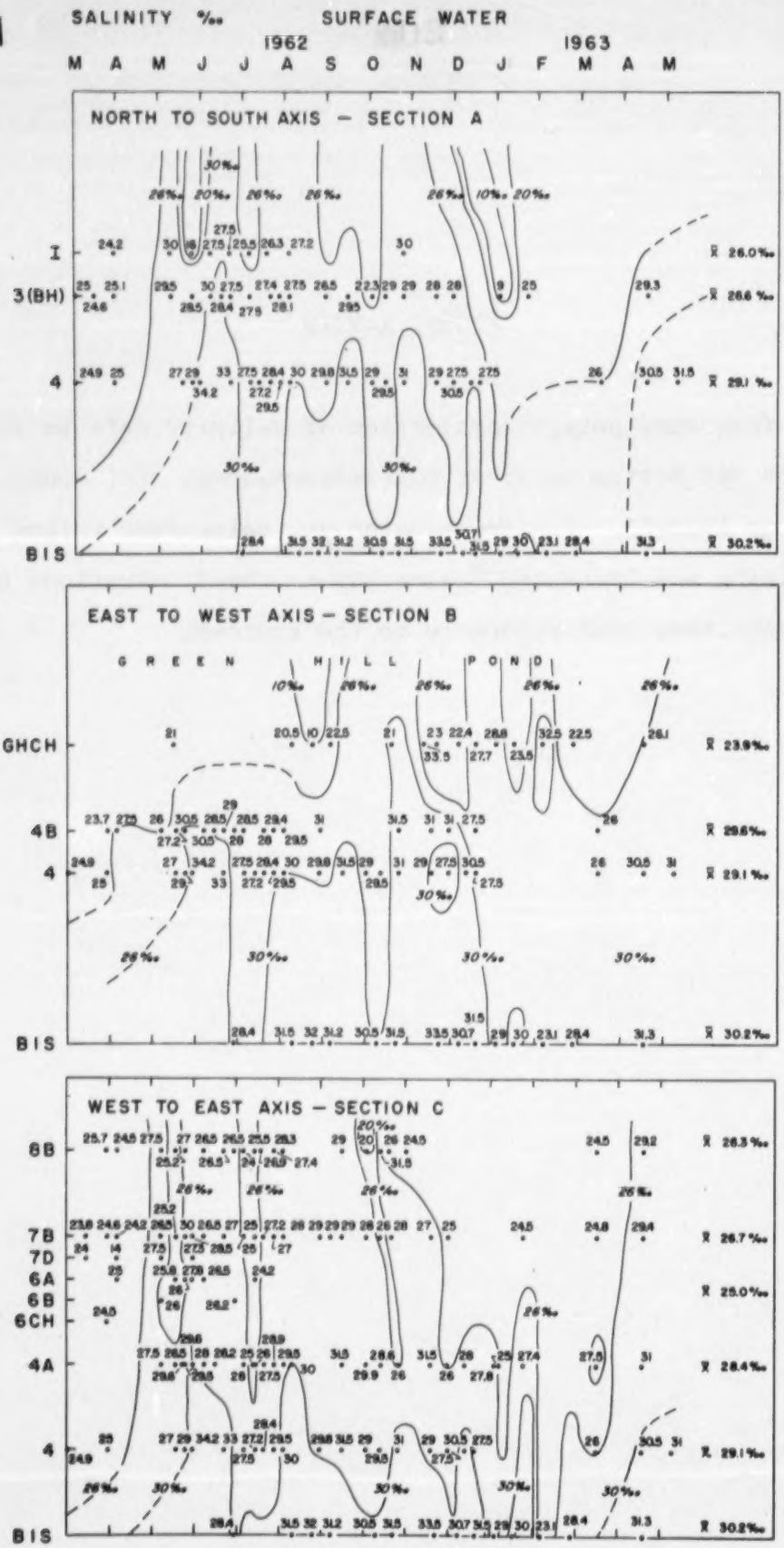
The following series of graphs are frequency polygon projections of data representing various environmental parameters measured seasonally along three axes of the lagoon. The axes indicated are as follows: Section A is a north-south oriented axis extending seaward from Fort Neck embayment, through Central Basin and the breachway into Block Island Sound; Section B is an east-west oriented axis extending from Green Hill Pond through the tidal river into Central Basin and the breachway into Block Island Sound; Section C is a west-east oriented axis extending from the west end of West Basin through the narrows, Central Basin, and the breachway into Block Island Sound. Both surface and bottom projections include data for the fresh-water creeks and the Block Island Sound water data for interpretative purposes.

Along the left hand side of each figure appear station numbers identified in Figure A-1. The time of each measurement is shown in months of the year at the top of each figure (Sampling periods were usually bimonthly). The changes in isopleths, points of equal value, indicate the seasonal fluctuations of each variable in the lagoon.

By analyzing the configuration of the isopleths it is possible to determine the sources, areas of seasonally low or high concentration, or uptake, and biological activity as related to each variable. Data presented in this form are suitable for graphical analysis.

FIGURE A-9S/B

A frequency polygon projection of salinity data in the surface and bottom water of Charlestown-Green Hill Ponds, R. I. in 1962-63. The fresh-water vs. salt-water influx and mixing are indicated seasonally in the fluctuations of the isohalines with reference to the sources.


SALINITY ‰
SURFACE WATER
1962
1963
M A M J J A S O N D J F M A M
NORTH TO SOUTH AXIS — SECTION A
I
3(BH)
4
BIS
EAST TO WEST AXIS — SECTION B
GREEN HILL POND
GHCH
4B
4
BIS
WEST TO EAST AXIS — SECTION C
6B
7B
7D
6A
6B
6CH
4A
4
BIS

SALINITY ‰ BOTTOM WATER

1962 1963

M A M J J A S O N D J F M A M

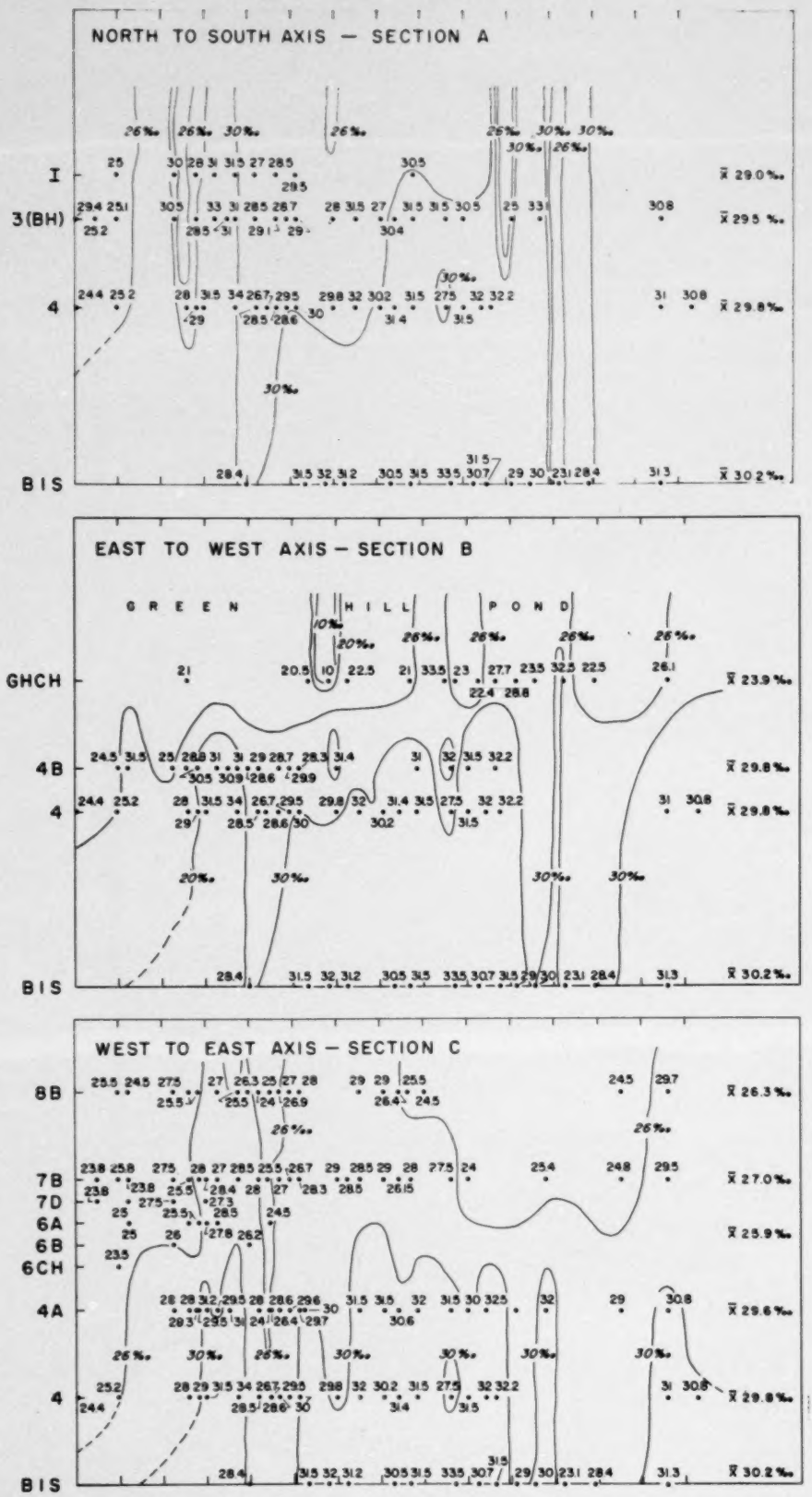


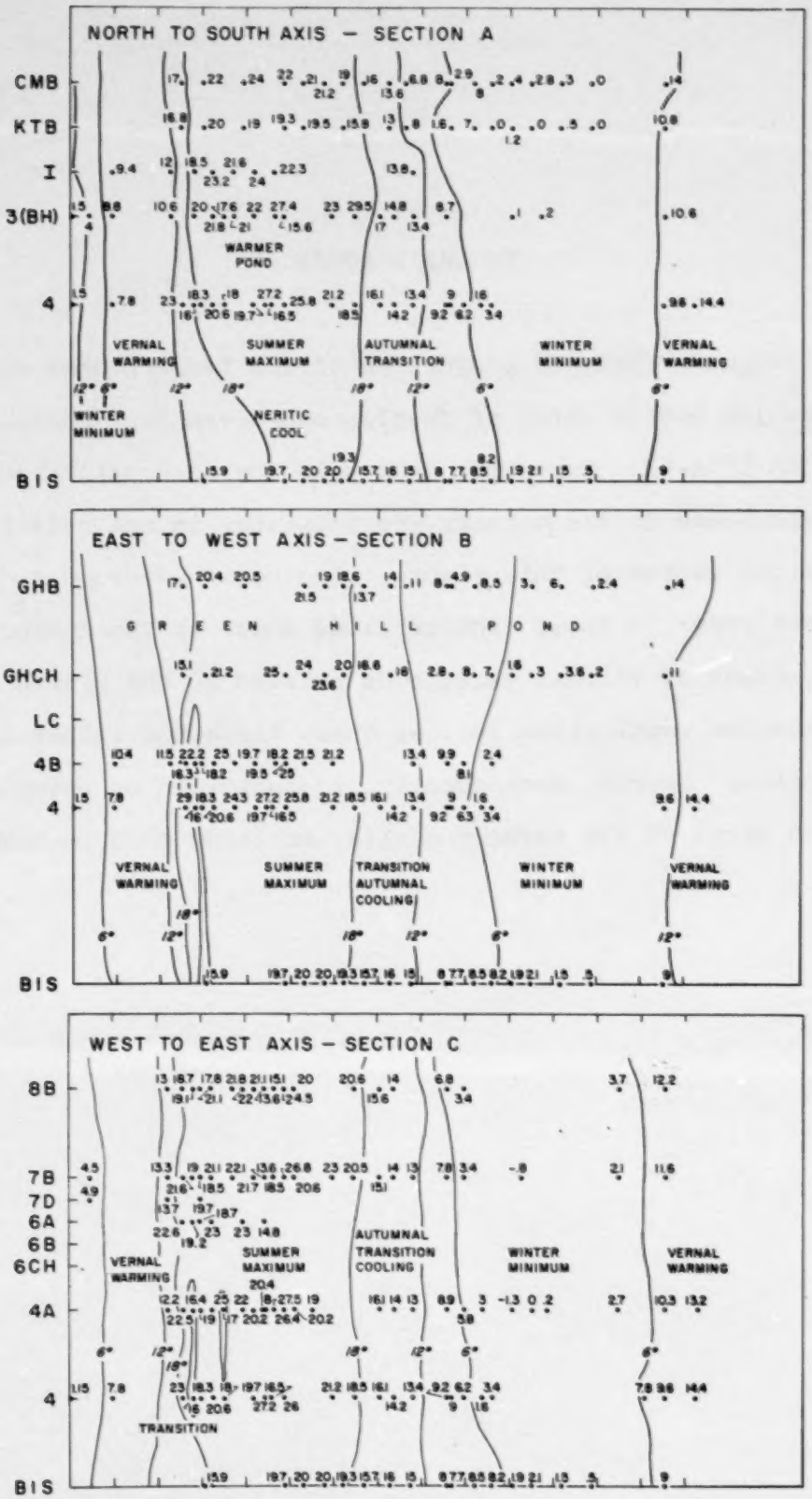
FIGURE A-10S/B

A frequency polygon projection of the temperatures of the surface and bottom water of Charlestown-Green Hill Ponds, R. I. in 1962-63. Important events in the seasonal temperature phenomena in the estuary are indicated in the notations across the center of this figure. Isotherms referred to in the text refer to those contour lines shown in the graph. This concept of thermal thresholds related to the growth of some species populations follows these isotherms rather than time alone. Growth, consequently, is inhibited or stimulated in some parts of the estuary earlier or later than in other parts.

TEMPERATURE °C SURFACE WATER

1962 1963

M A M J J A S O N D J F M A M



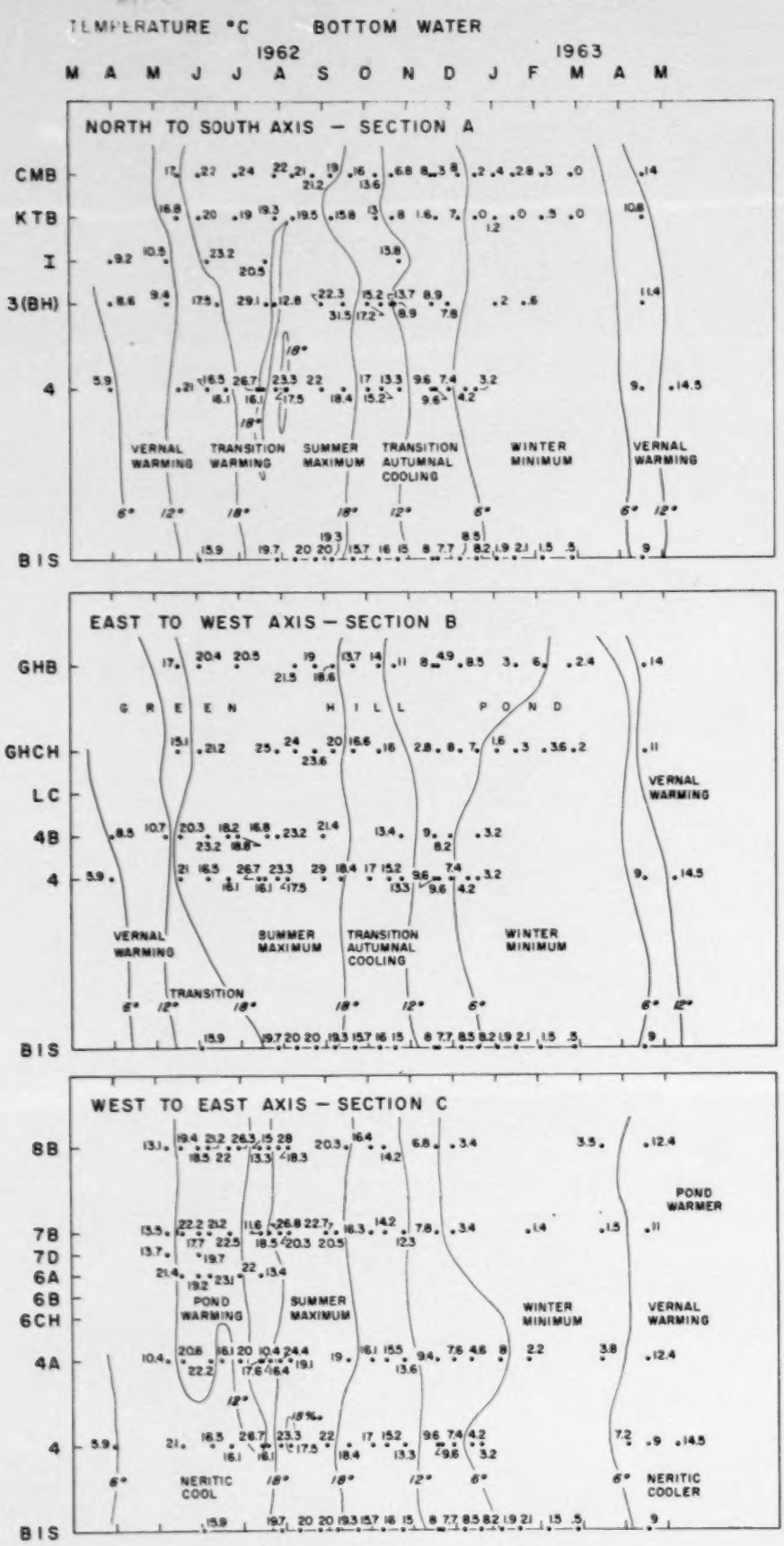

TEMPERATURE °C BOTTOM WATER
1962
1963
M A M J J A S O N D J F M A M
NORTH TO SOUTH AXIS — SECTION A
CMB
KTB
I
3(BH)
4
BIS
VERNAL WARMING
TRANSITION WARMING
SUMMER MAXIMUM
TRANSITION AUTUMNAL COOLING
WINTER MINIMUM
VERNAL WARMING
EAST TO WEST AXIS — SECTION B
GHB
GREEN HILL POND
GHCH
LC
4B
4
VERNAL WARMING
SUMMER MAXIMUM
TRANSITION AUTUMNAL COOLING
WINTER MINIMUM
VERNAL WARMING
TRANSITION
BIS
WEST TO EAST AXIS — SECTION C
8B
7B
7D
6A
6B
6CH
4A
4
BIS
POND WARMER
POND WARMING
SUMMER MAXIMUM
WINTER MINIMUM
VERNAL WARMING
NERITIC COOL
NERITIC COOLER

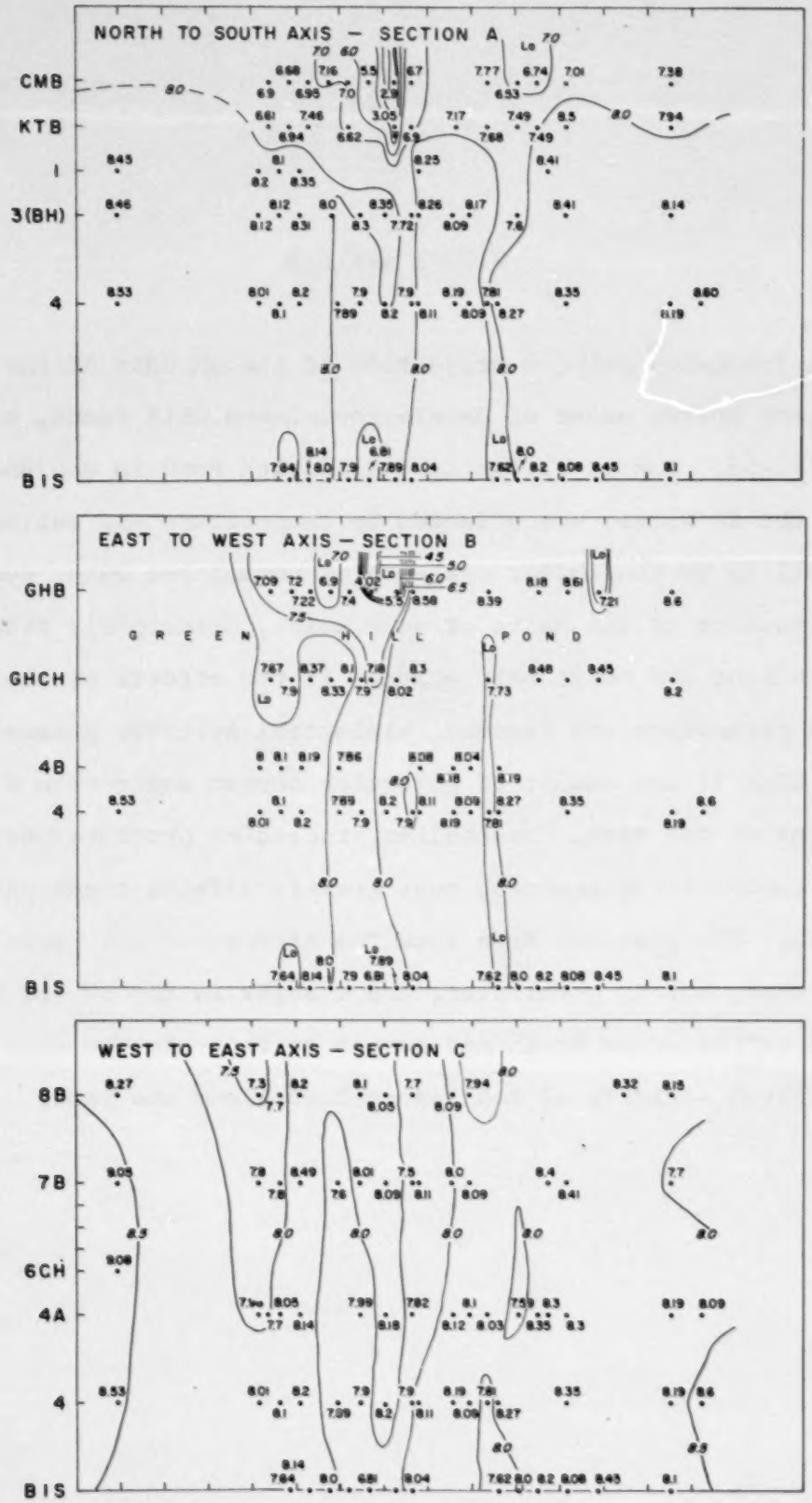
FIGURE A-11S/B

A frequency polygon projection of the pH data of the surface and bottom water of Charlestown-Green Hill Ponds, R. I. in 1962-63. The pH values in Charlestown Pond in conjunction with the Eh values are affected by temperature and salinity as well as by the buffer capacity of normal sea water due to the presence of the salts of weak acids, principally bicarbonate ions and boric acid salts. If the effects of the above parameters are removed, biological activity predominates according to the amount of molecular oxygen and carbon dioxide present at the time. Metabolism, including photosynthesis and respiration processes, most gravely affects these parameters. The seasonal data show the effects of all variables mentioned, but in particular, the changes in the pH and Eh, or as ratios of pH to Eh and oxygen to indicate the general biological activity of the lagoon throughout the year.

pH SURFACE WATER

1962 1963

M A M J J A S O N D J F M A M



pH BOTTOM WATER

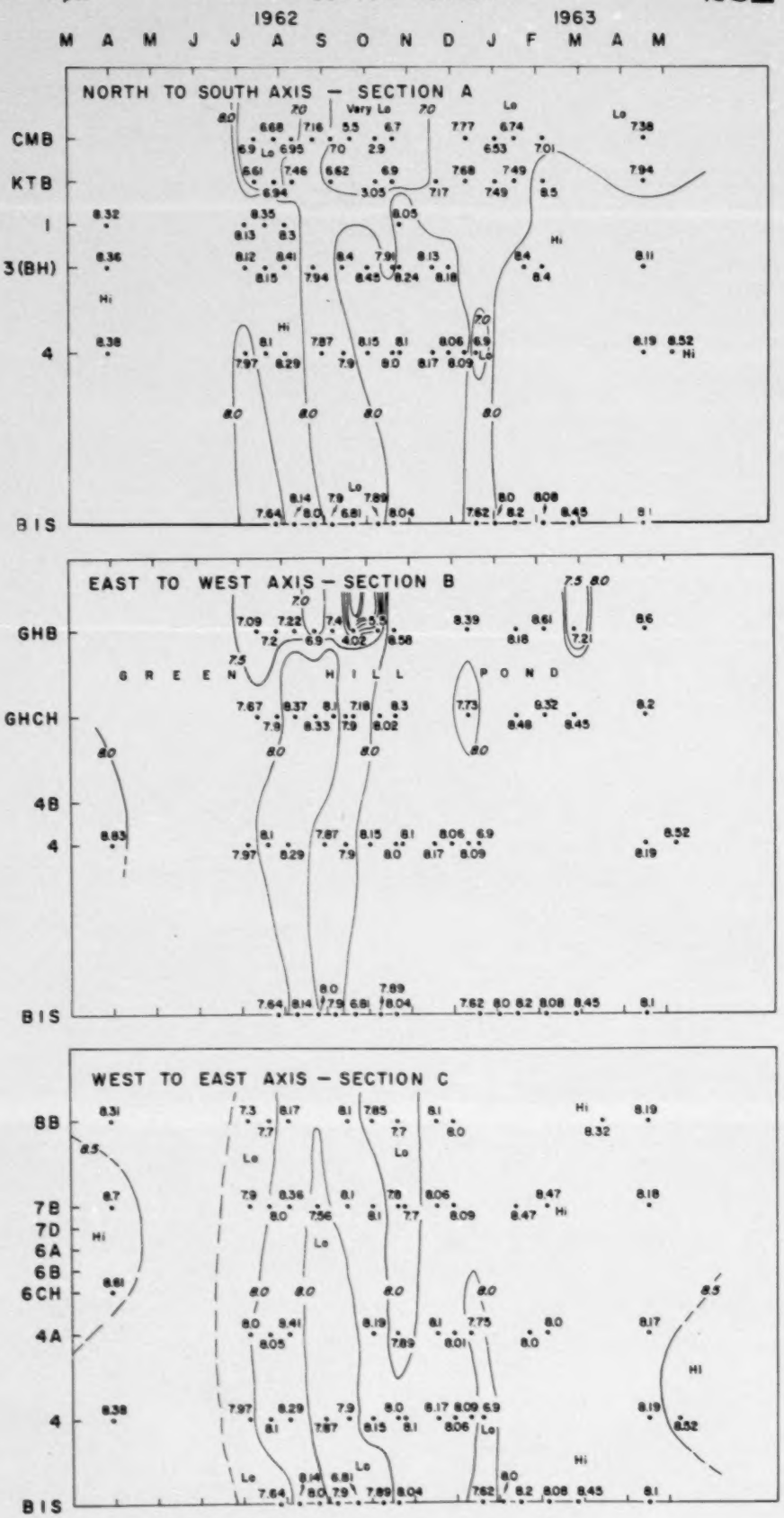
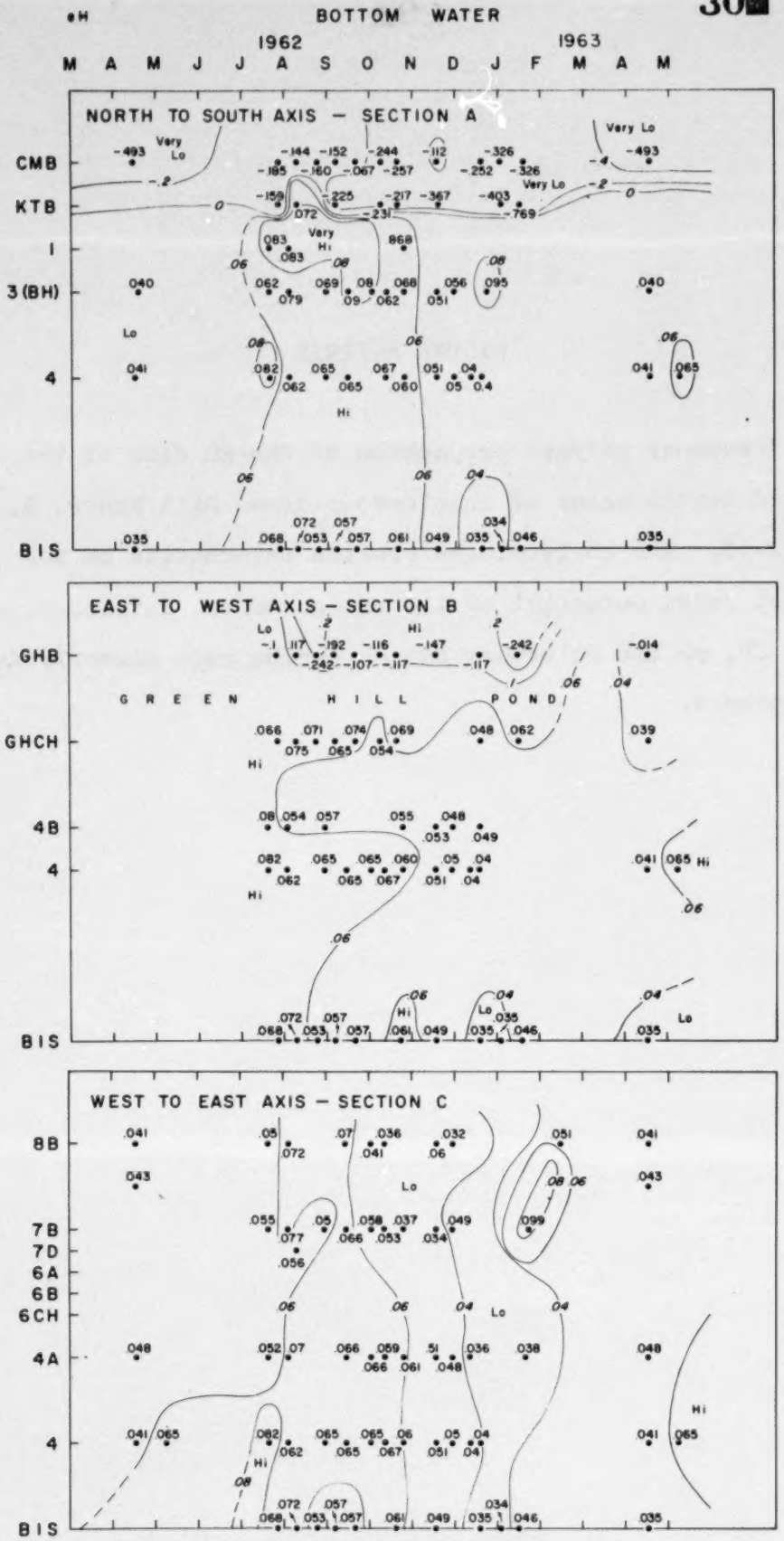


FIGURE A-12S/B

A frequency polygon projection of the Eh data of the surface and bottom water of Charlestown-Green Hill Ponds, R. I. in 1962-63. The Eh isopleths provide information on the seasonal redox potential of the environment. Interpretive use of Eh, pH and molecular oxygen can be made directly from these graphs.


eH
BOTTOM WATER
1962
1963
M A M J J A S O N D J F M A M
NORTH TO SOUTH AXIS — SECTION A
CMB
KTB
I
3(BH)
4
BIS
Very Lo
Very Hi
Lo
Hi
EAST TO WEST AXIS — SECTION B
GHB
GHCH
4B
4
BIS
G R E E N H I L L P O N D
WEST TO EAST AXIS — SECTION C
8B
7B
7D
6A
6B
6CH
4A
4
BIS

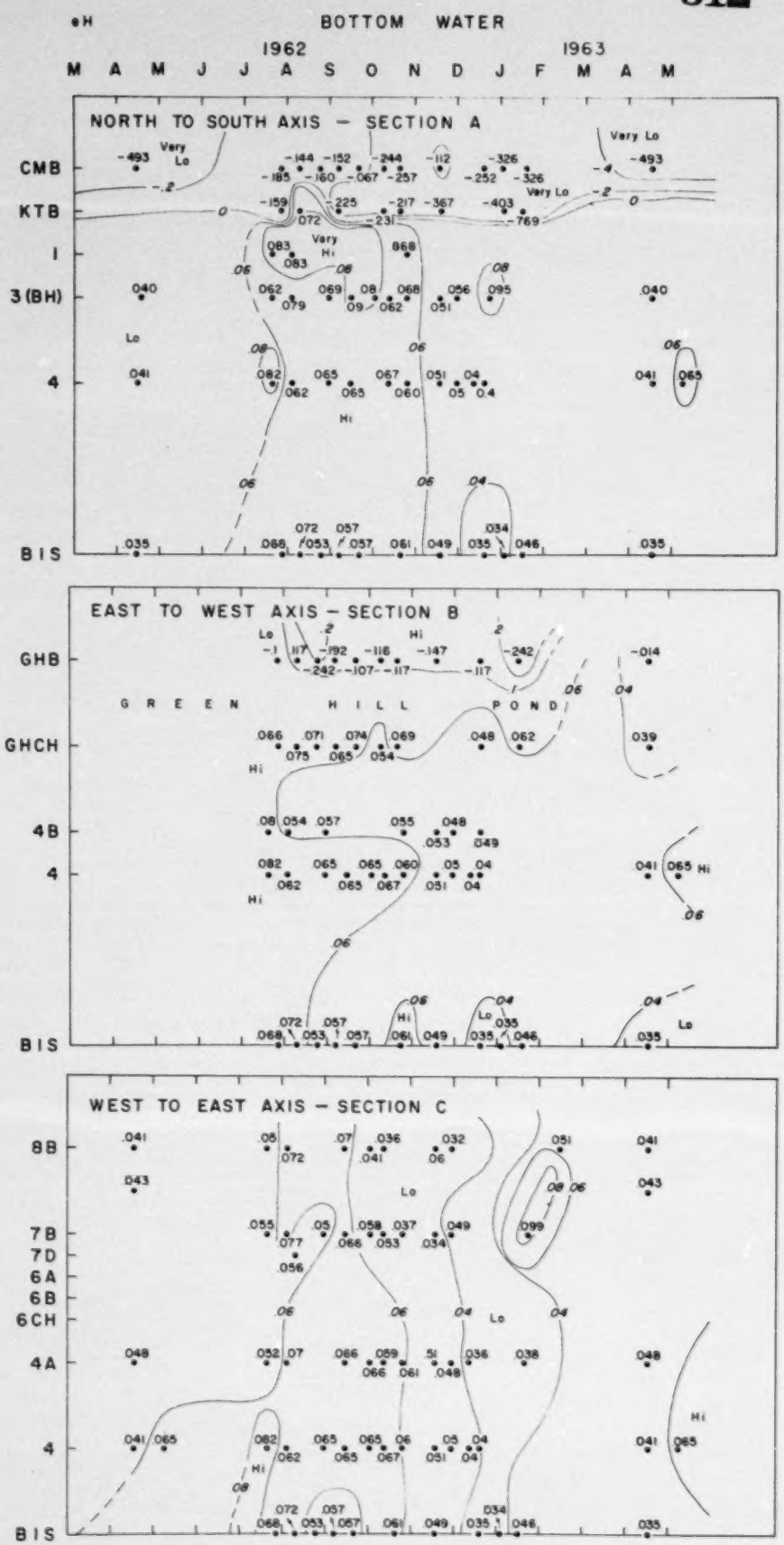
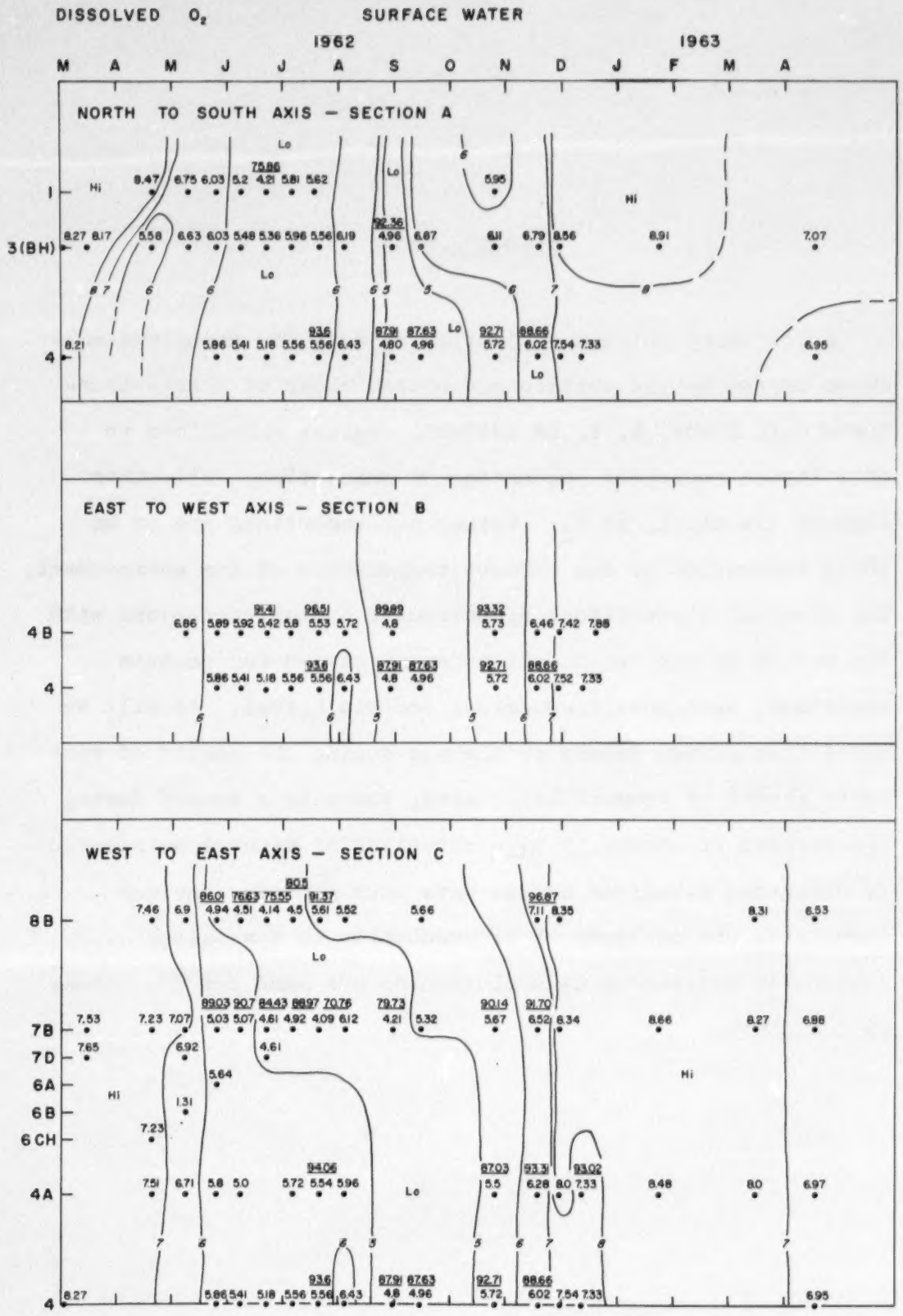

eH
BOTTOM WATER
1962
1963
M A M J J A S O N D J F M A M
NORTH TO SOUTH AXIS – SECTION A
CMB
KTB
I
3(BH)
4
BIS
EAST TO WEST AXIS – SECTION B
GHB
GHCH
4B
4
BIS
GREEN HILL POND
WEST TO EAST AXIS – SECTION C
8B
7B
7D
6A
6B
6CH
4A
4
BIS

FIGURE A-13S/B

A frequency polygon projection of data for dissolved molecular oxygen in the surface and bottom water of Charlestown-Green Hill Ponds, R. I. in 1962-63. Values underlined in this figure represent percentage of saturation. All other figures are ml./l. of O_2. Values not underlined are at or above saturation at the ambient temperature of the environment. The seasonal fluctuations of molecular oxygen correspond with the events in the lagoon which demand oxygen for certain reactions, both physico-chemical and biological. It will be noted that oxygen demand is highest during the period of most rapid growth of communities. Also, there is a demand during the periods of strong <u>in situ</u> recycling of mineral nutrients. By comparing dissolved oxygen data with pH data, one may generalize the patterns of bioproduction in the lagoon seasonally related to O_2 evolution on one hand and CO_2 uptake on the other.


DISSOLVED O_2
SURFACE WATER
1962
1963
M A M J J A S O N D J F M A
NORTH TO SOUTH AXIS — SECTION A
1
3(BH)
4
EAST TO WEST AXIS — SECTION B
4 B
4
WEST TO EAST AXIS — SECTION C
8 B
7B
7D
6A
6B
6 CH
4A
4
Hi
Lo

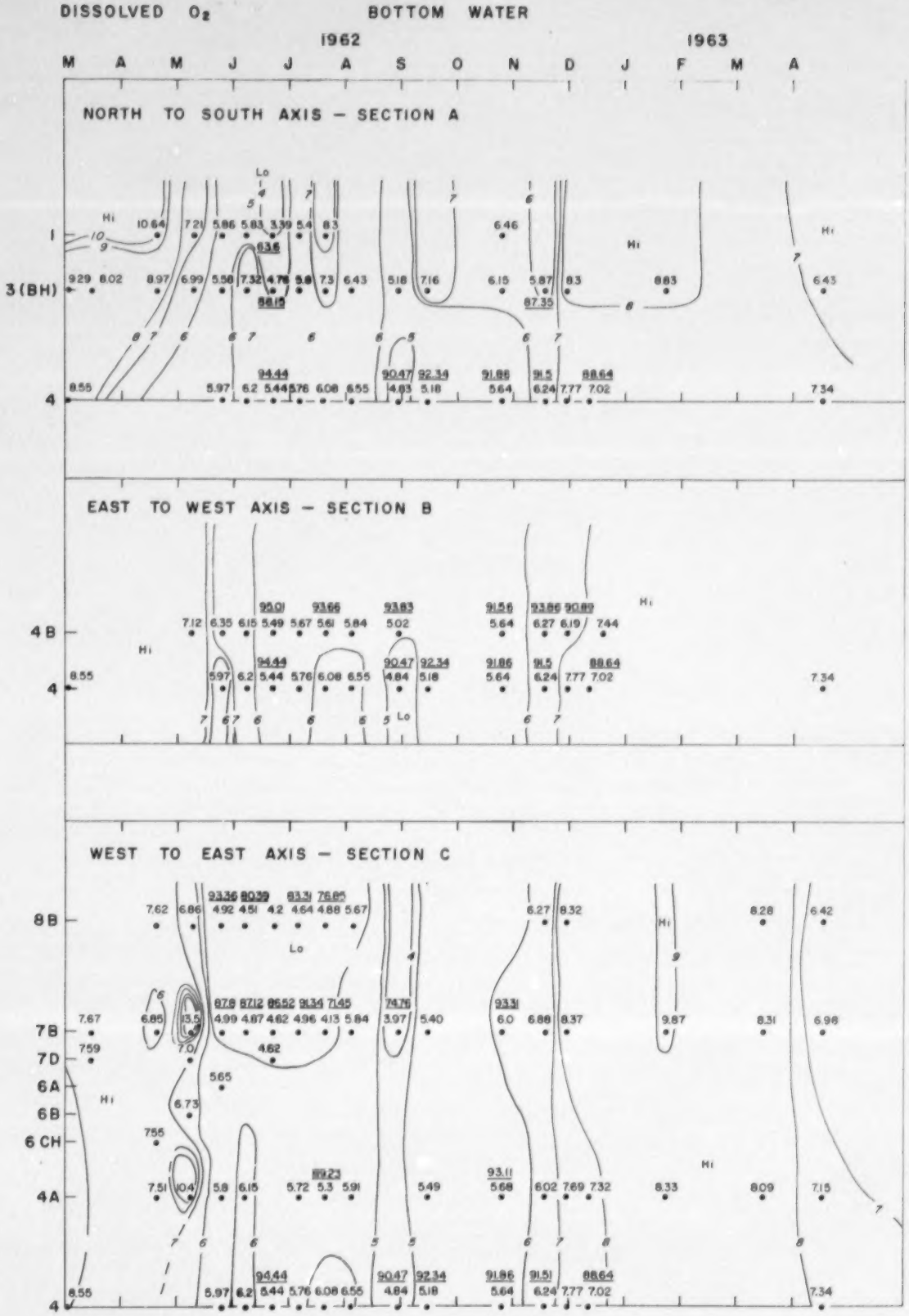

DISSOLVED O_2
BOTTOM WATER
1962
1963
M A M J J A S O N D J F M A
NORTH TO SOUTH AXIS – SECTION A
1
3(BH)
4
EAST TO WEST AXIS – SECTION B
4B
4
WEST TO EAST AXIS – SECTION C
8B
7B
7D
6A
6B
6 CH
4A
4
Hi
Lo

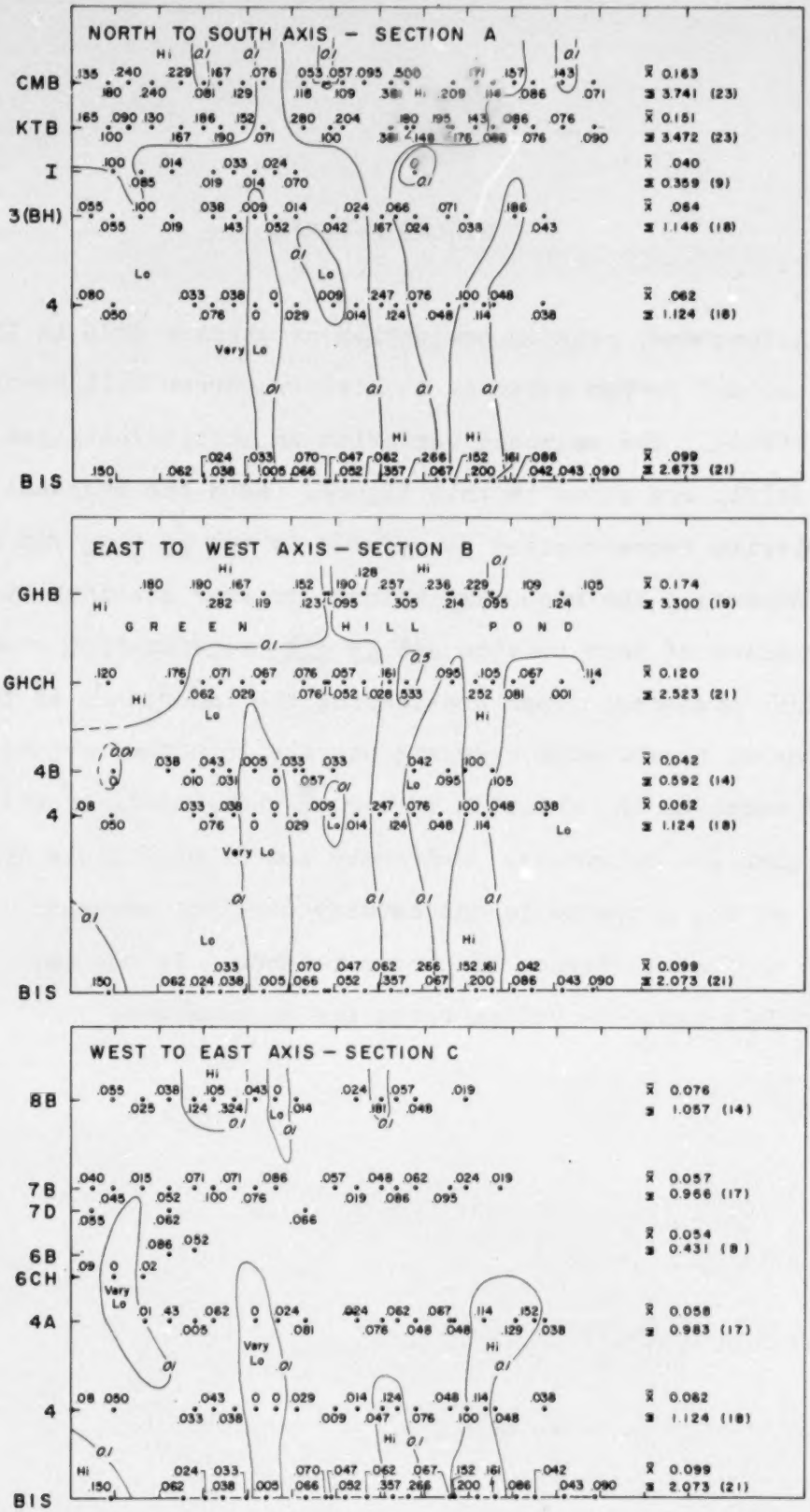
FIGURE A-14S/B

A frequency polygon projection of nitrite data in the surface and bottom water of Charlestown-Green Hill Ponds, R. I. in 1962-63. The seasonal variation in nitrite/nitrogen in ug. at./l. are shown in this figure. Note the seasonal change in nitrite concentration as related to the in situ and run-off sources. The high mean values for some stations are indicative of both outside and in situ regeneration sources of this property. When considering the importance of the influx of fresh-water carrying nitrite into the system, one must consider the dilution factor of these small creeks entering the embayment. Extremely low or negligible measurement of the property in the estuary does not necessarily mean the total absence of this substance. It may mean extremely rapid recycling rates are in progress.

NO_2 µg-at/L SURFACE WATER

1962 1963

M A M J J A S O N D J F M A M



NO_2 µg-at/L BOTTOM WATER

1962 1963

M A M J J A S O N D J F M A M

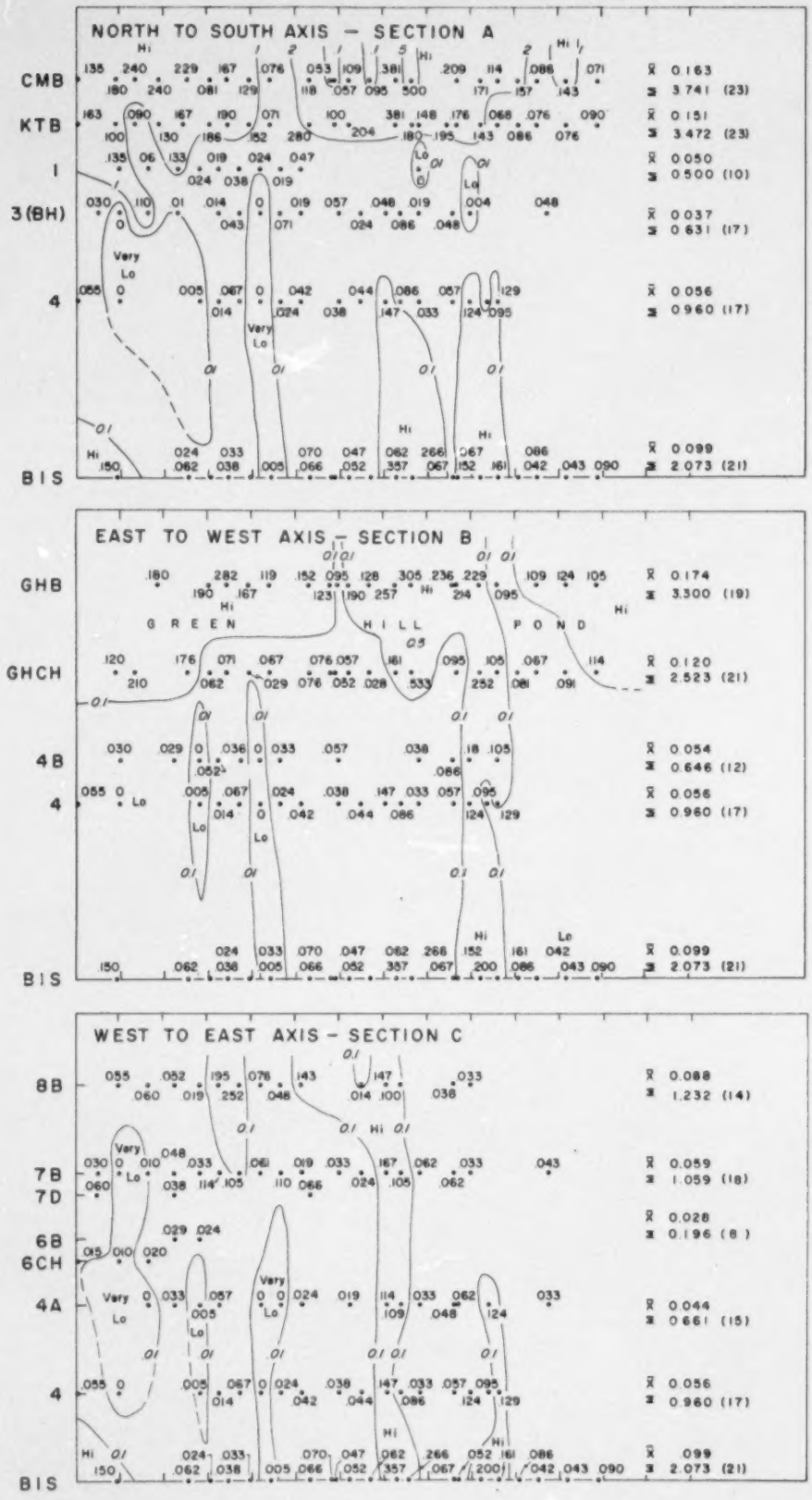


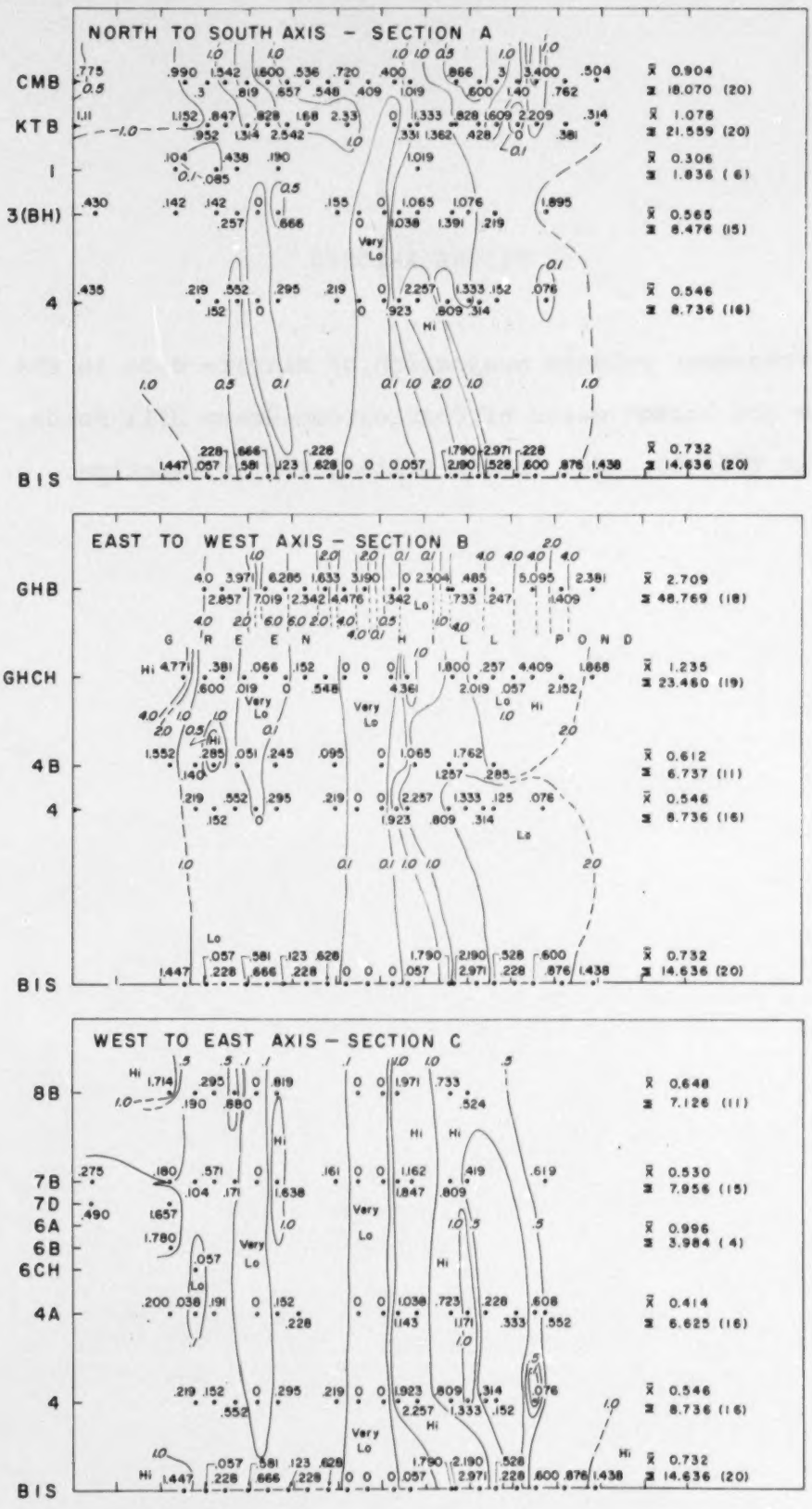
FIGURE A-15S/B

A frequency polygon projection of nitrate data in the surface and bottom water of Charlestown-Green Hill Ponds, R. I. in 1962-63. See Figure A-14S/B for explanation.

NO_3 ug-at/L SURFACE WATER

1962 1963

M A M J J A S O N D J F M A M



NO_3 N µg-at/L BOTTOM WATER

1962 1963

M A M J J A S O N D J F M A M

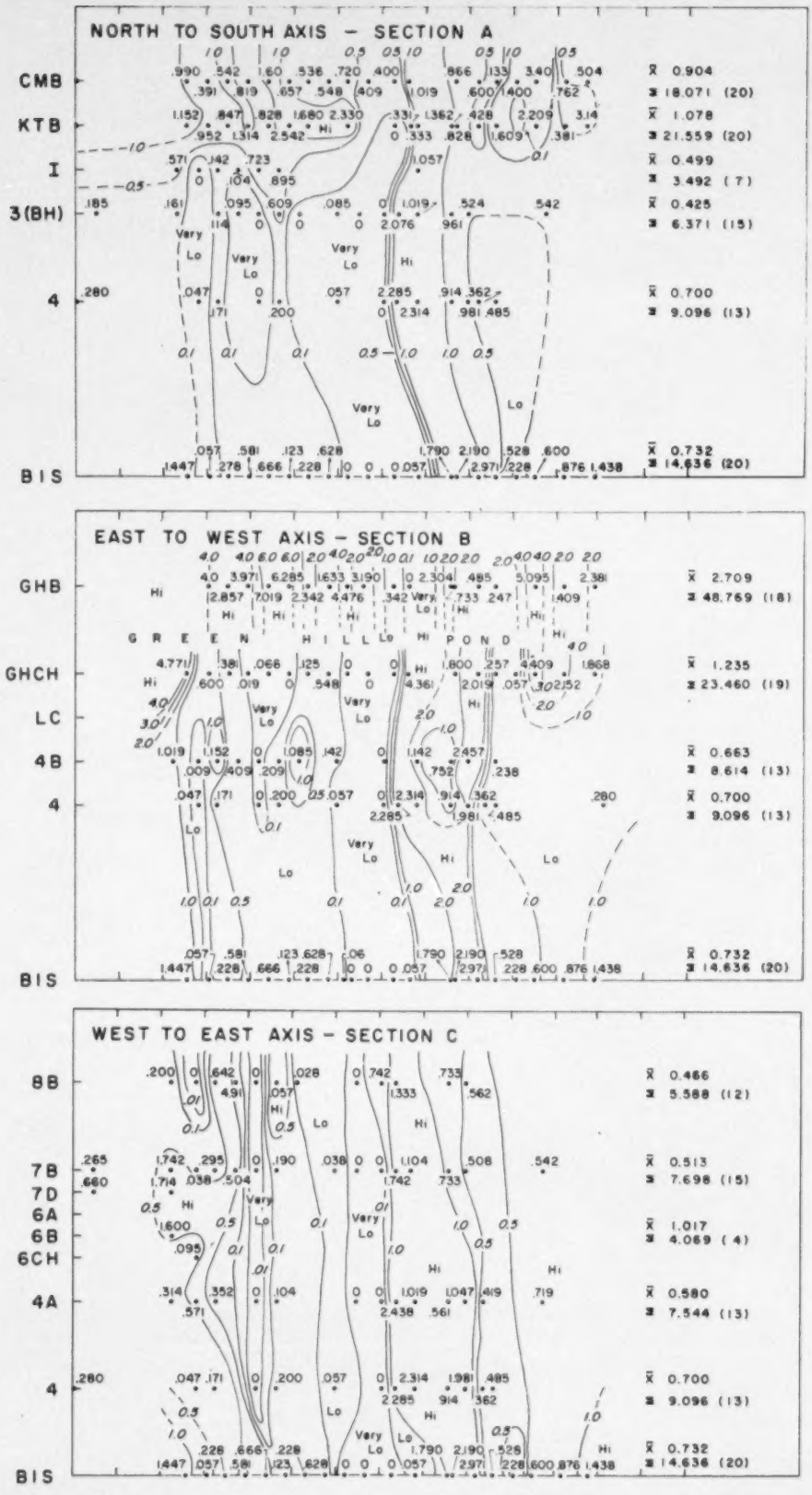
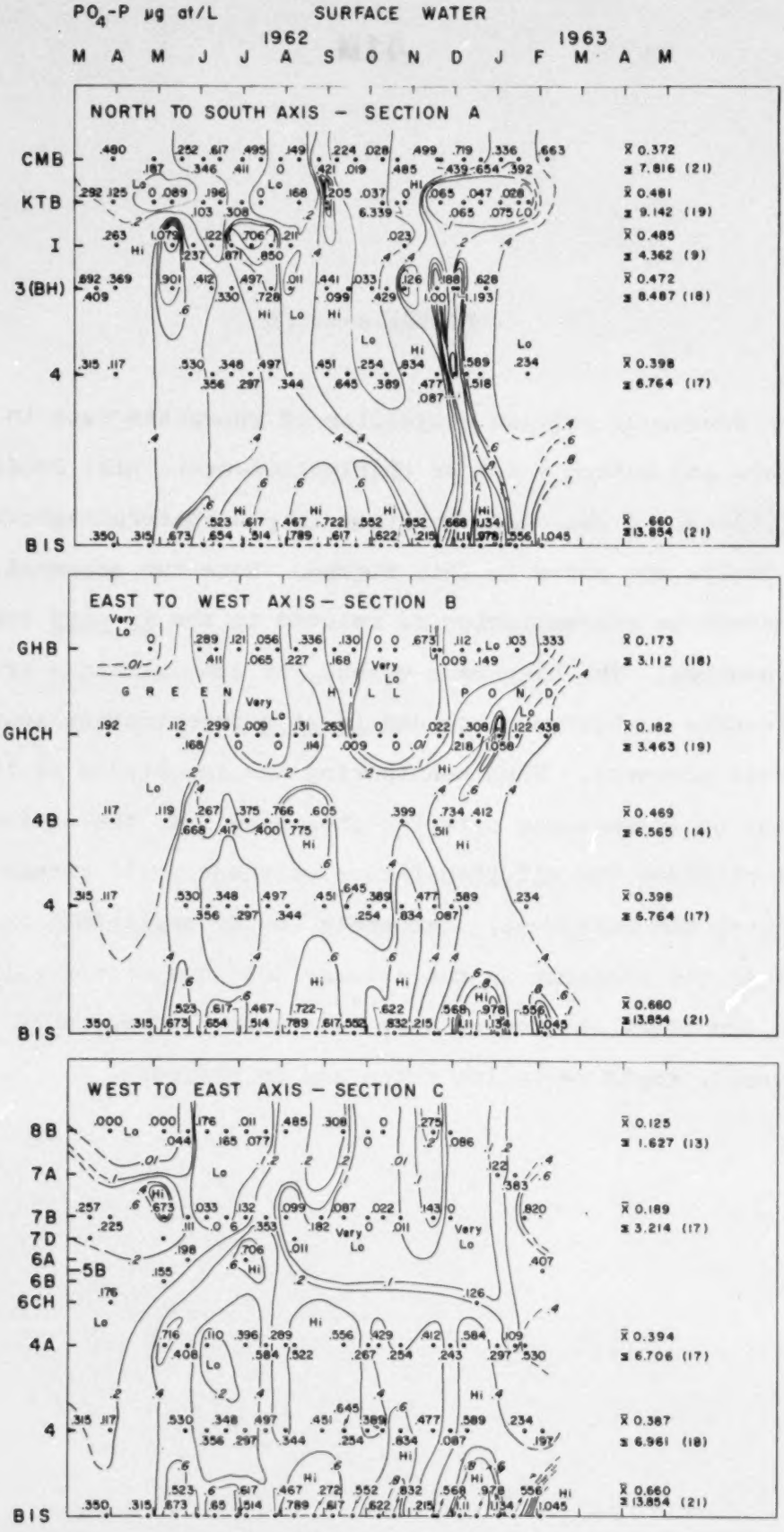


FIGURE A-16S/B

A frequency polygon projection of phosphate data in the surface and bottom water of Charlestown-Green Hill Ponds, R. I. in 1962-63. A seasonal variation in phosphate/phosphorus in μg. at./l. are shown in this figure. Note the seasonal change in phosphate concentration as related to the in situ and run-off sources. The high mean values for some stations are indicative of both outside and in situ regeneration sources of this property. When considering the importance of the influx of fresh-water carrying phosphate into the system, one must consider the dilution factor of these small creeks entering the embayment. Extremely low or negligible measurement of the property in the estuary does not necessarily mean the total absence of this substance. It may mean extremely rapid recycling rates are in progress.


PO_4-P µg at/L
SURFACE WATER
1962
1963
M A M J J A S O N D J F M A M
NORTH TO SOUTH AXIS – SECTION A
CMB
KTB
I
3(BH)
4
BIS
EAST TO WEST AXIS – SECTION B
GHB
GHCH
4B
4
BIS
WEST TO EAST AXIS – SECTION C
8B
7A
7B
7D
6A
5B
6B
6CH
4A
4
BIS

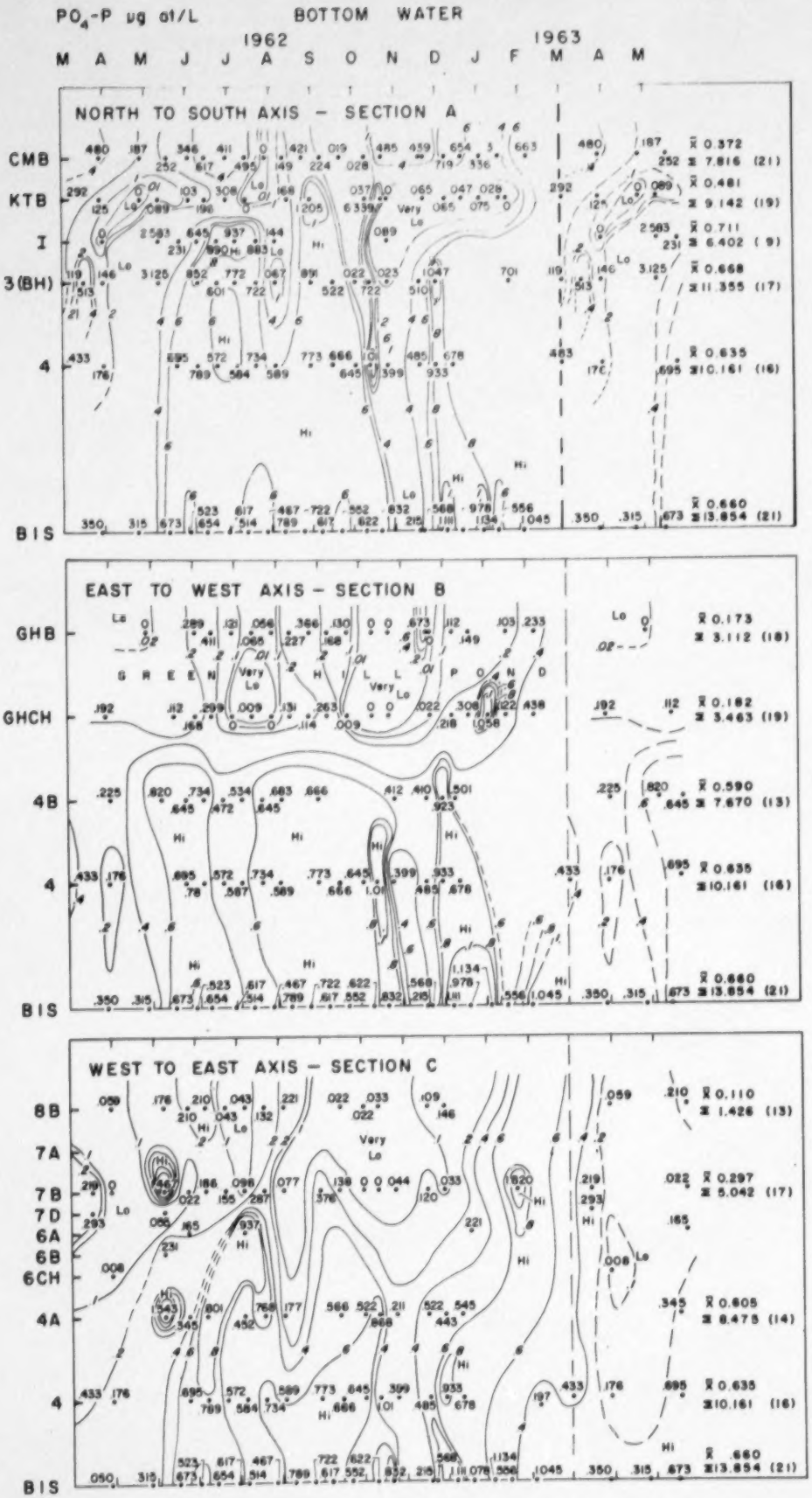

PO_4-P µg at/L
BOTTOM WATER
1962
1963
M A M J J A S O N D J F M A M
NORTH TO SOUTH AXIS – SECTION A
CMB
KTB
I
3(BH)
4
BIS
EAST TO WEST AXIS – SECTION B
GHB
GHCH
4B
4
BIS
WEST TO EAST AXIS – SECTION C
8B
7A
7B
7D
6A
6B
6CH
4A
4
BIS

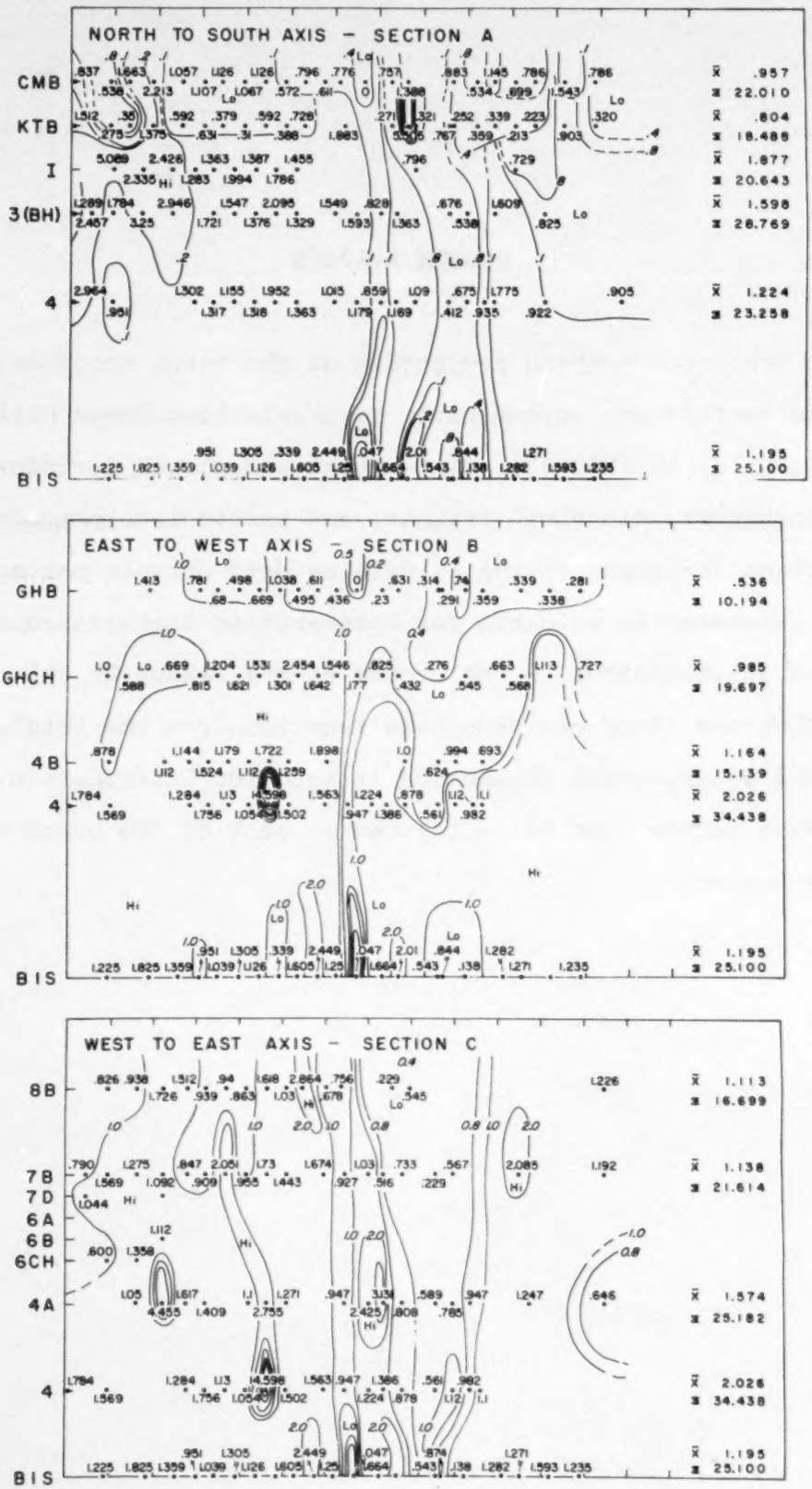
FIGURE A-17S/B

A frequency polygon projection of the total phosphorus in the surface and bottom water of Charlestown-Green Hill Ponds, R. I. in 1962-63. Since total phosphorus includes the inorganic, dissolved organic, and particulate organic fractions including living as well as dead organic matter, this parameter is valuable for interpreting instantaneous values of phosphorus in the system at any season by subtracting the inorganic phosphate fraction from the total. In this study, total phosphorus is used for interpretive purposes rather than being figured as part of the phosphorus cycle budget.

TOTAL PHOSPHORUS SURFACE WATER

1962 1963

M A M J J A S O N D J F M A M



TOTAL PHOSPHORUS BOTTOM WATER

1962 1963

M A M J J A S O N D J F M A M

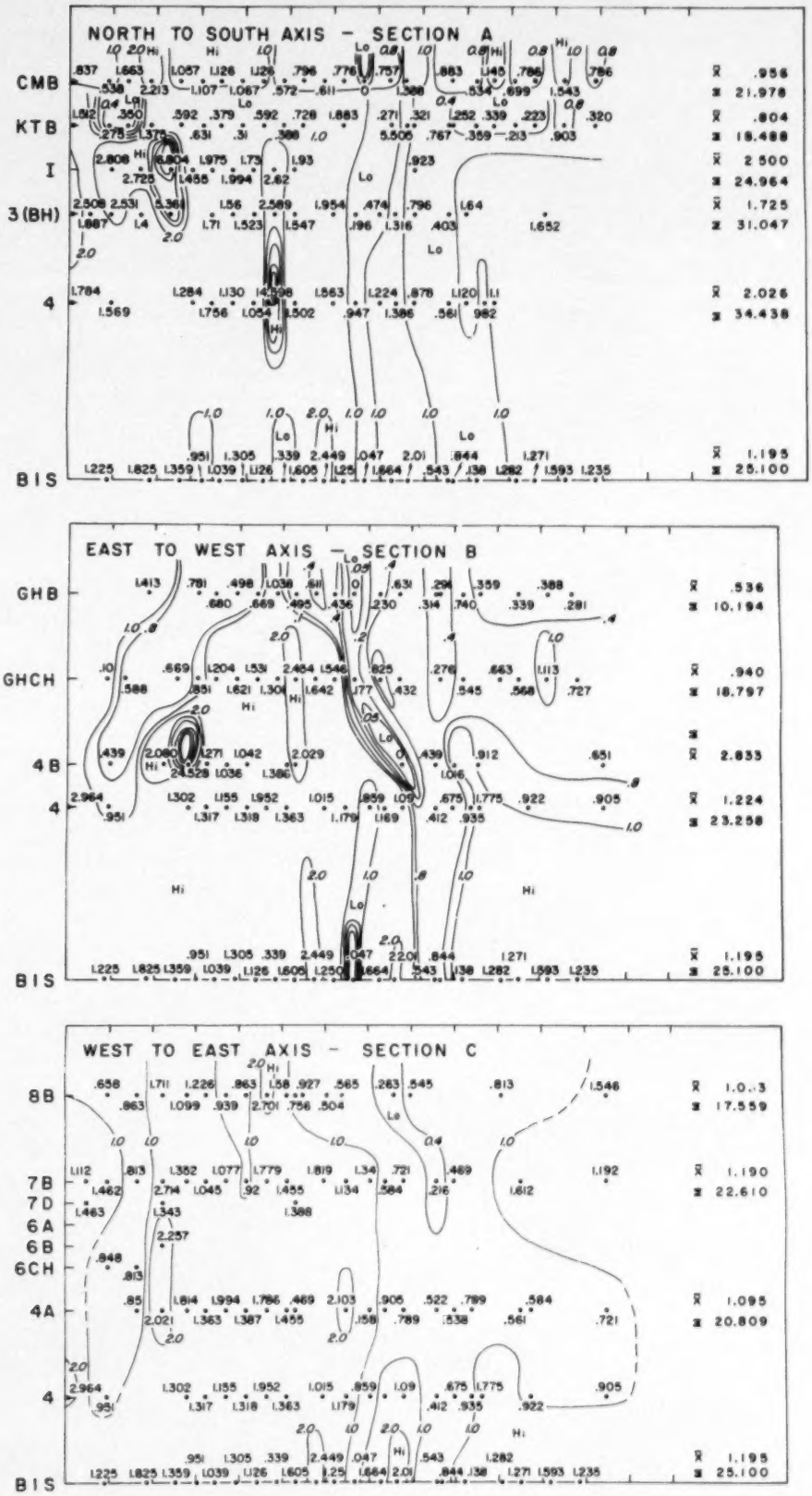
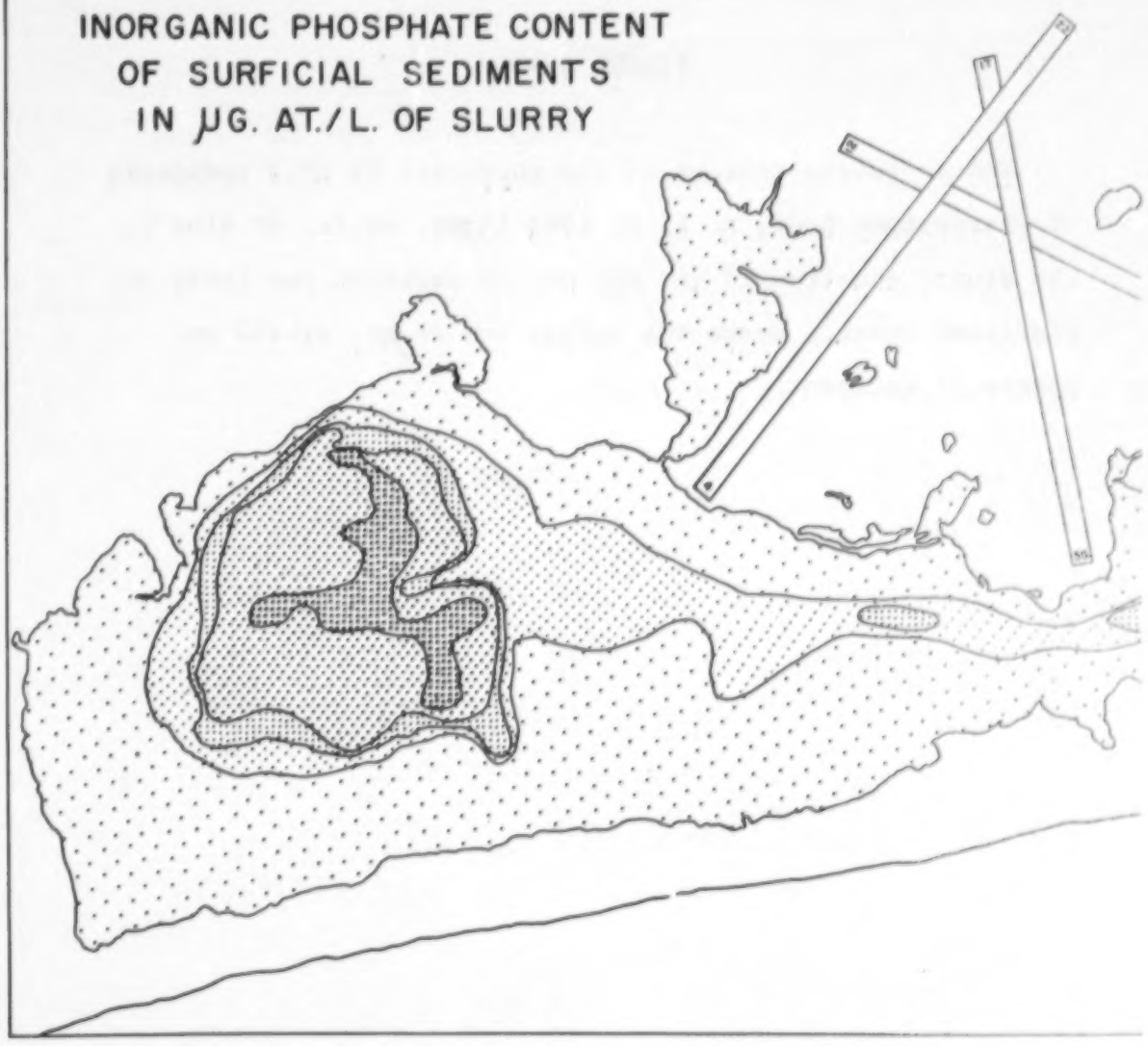


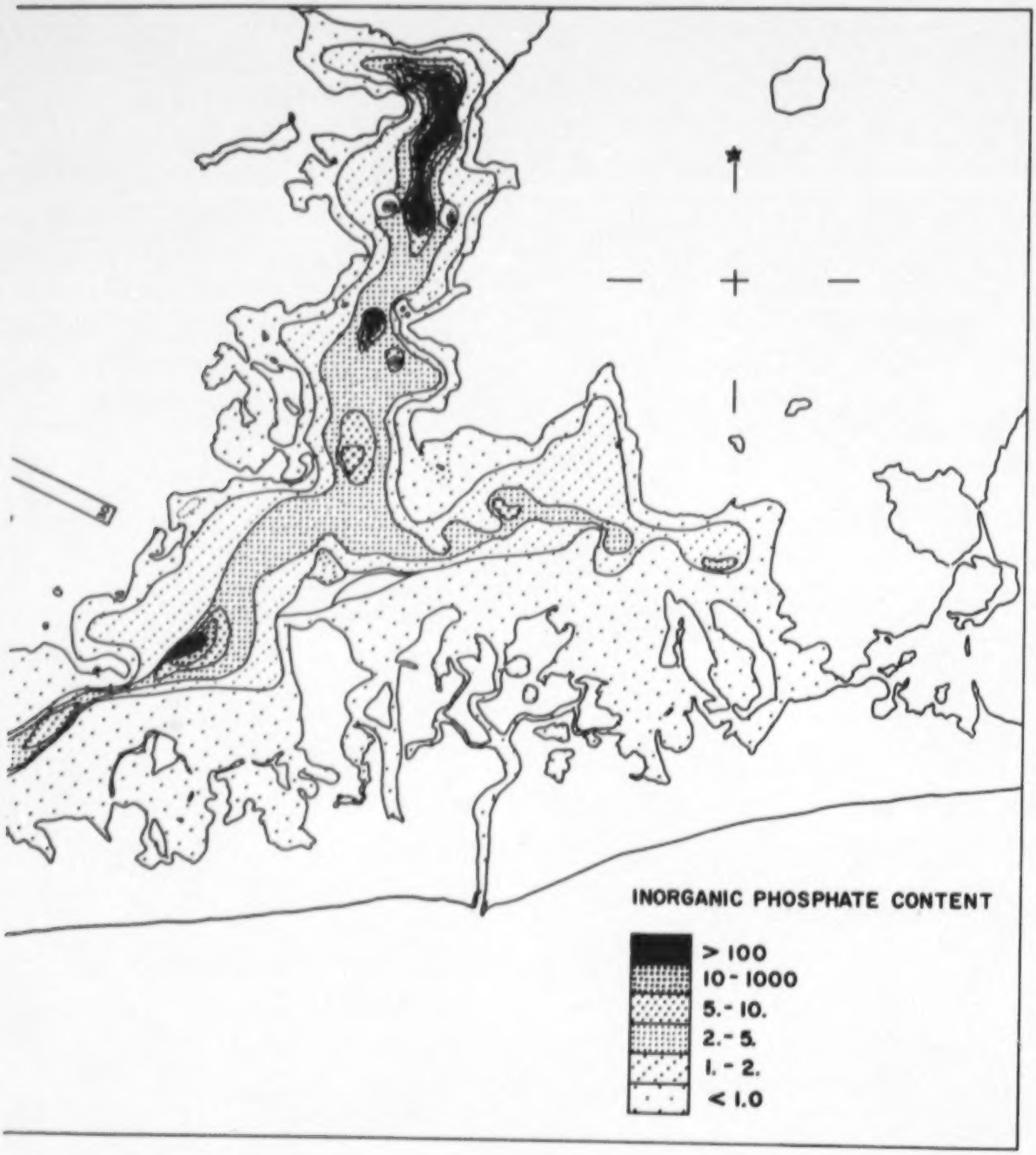
FIGURE A-18

The phosphate content of the surficial (2 cm.) sediments of Charlestown Pond, R. I. in 1963 in μg. at./l. of slurry. The slurry equalled 10 gm. dry wt. of sediment per liter of distilled water. Hence the values are in μg. at./10 gm. sample of sediment.

CHARLESTOWN POND, RHODE ISLAND

INORGANIC PHOSPHATE CONTENT
OF SURFICIAL SEDIMENTS
IN µG. AT./L. OF SLURRY




INORGANIC PHOSPHATE CONTENT
> 100
10 - 1000
5. - 10.
2. - 5.
1. - 2.
< 1.0

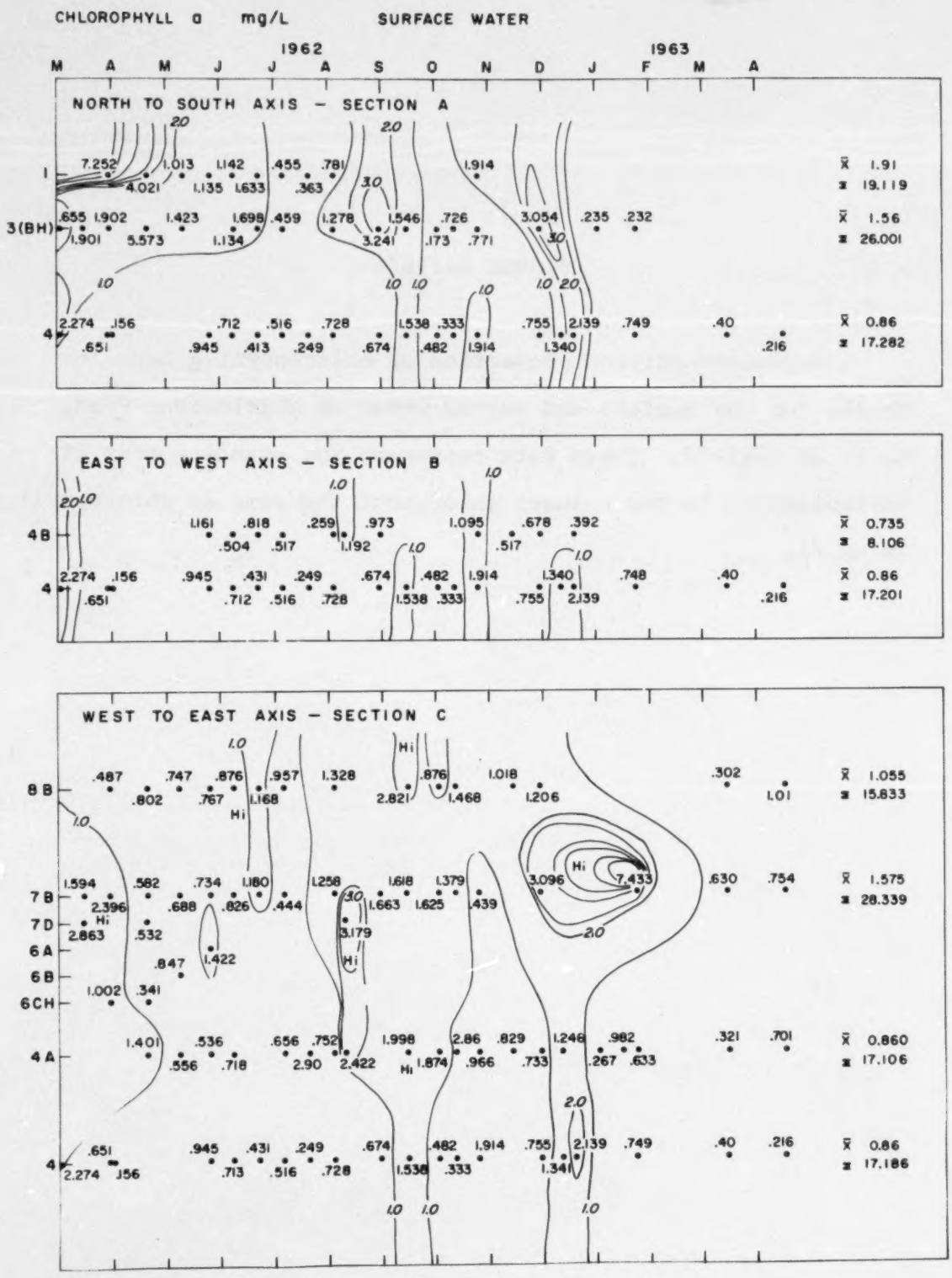

CHLOROPHYLL a mg/L SURFACE WATER
1962
1963
M A M J J A S O N D J F M A
NORTH TO SOUTH AXIS – SECTION A
1
3(BH)
4
x̄ 1.91
s 19.119
x̄ 1.56
s 26.001
x̄ 0.86
s 17.282
EAST TO WEST AXIS – SECTION B
4B
4
x̄ 0.735
s 8.106
x̄ 0.86
s 17.201
WEST TO EAST AXIS – SECTION C
8B
7B
7D
6A
6B
6CH
4A
4
x̄ 1.055
s 15.833
x̄ 1.575
s 28.339
x̄ 0.860
s 17.106
x̄ 0.86
s 17.186

FIGURE A-19S/B

A frequency polygon projection of chlorophyll a data in mg./l. for the surface and bottom water of Charlestown Pond, R. I. in 1962-63. These data represent the standing crop of phytoplankton in the estuary throughout the year as chlorophyll a in mg./l.

CHLOROPHYLL a mg/L BOTTOM WATER

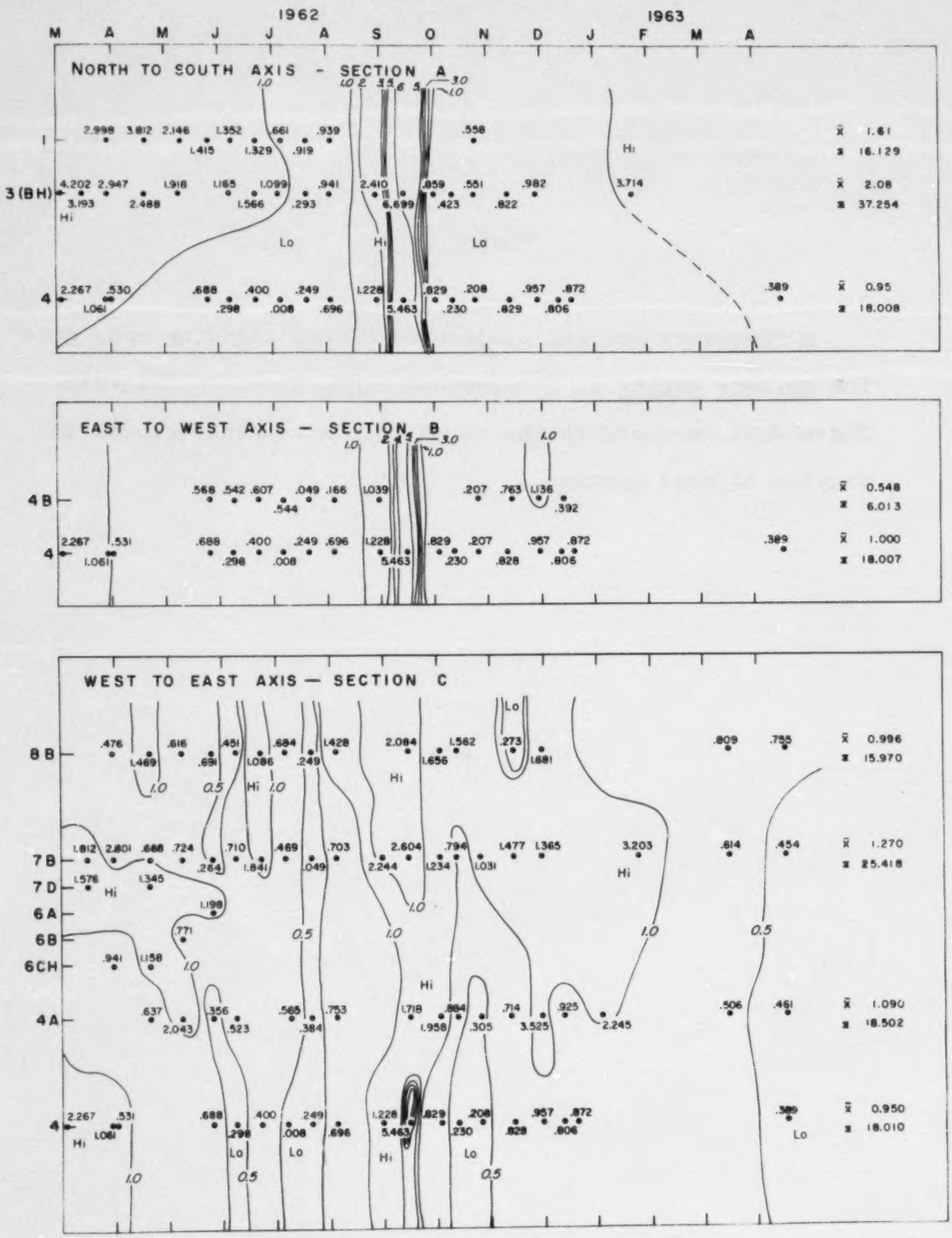


FIGURE A-20

A frequency polygon projection of the standing crop data for Zostera marina in Charlestown Pond, R. I. in 1961-63. These data demonstrate the quantitative seasonal growth and decline of this species.

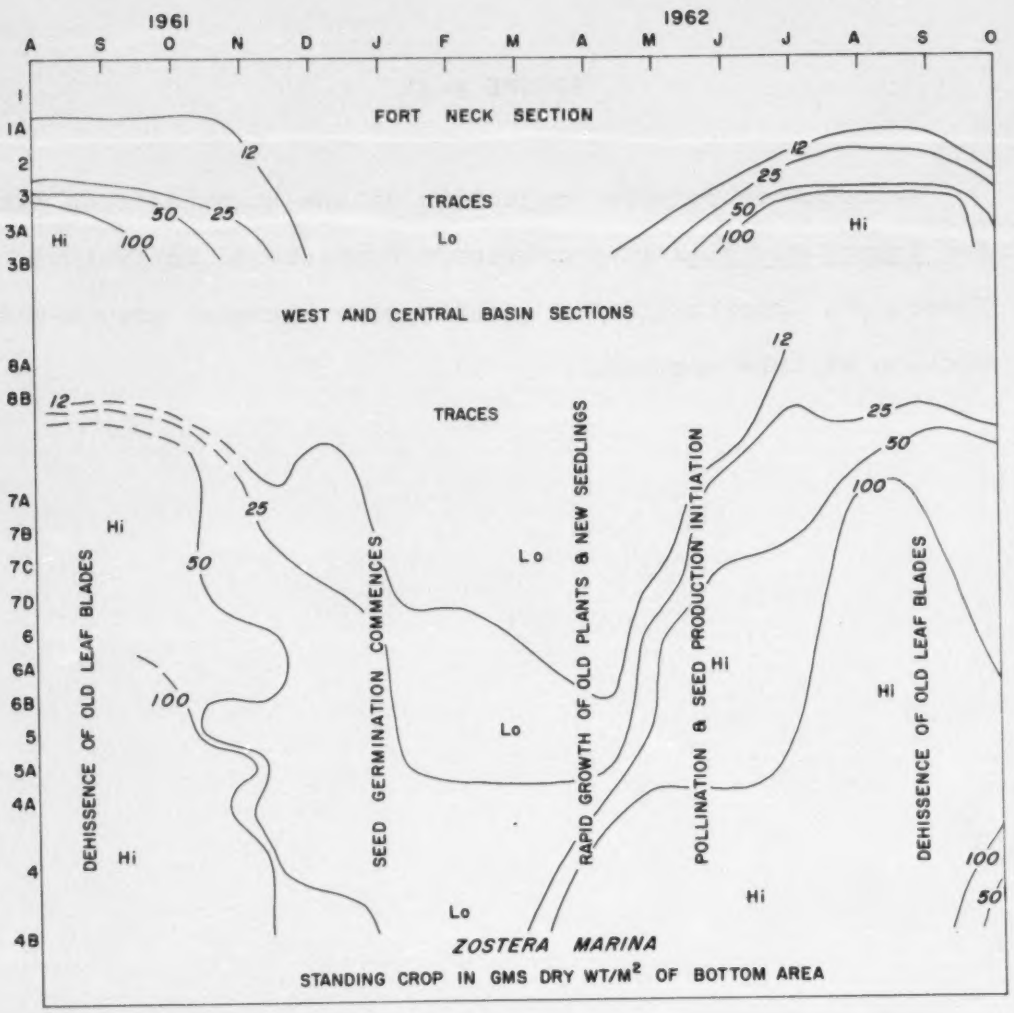

1961
1962
A S O N D J F M A M J J A S O
FORT NECK SECTION
TRACES
Hi
Lo
Hi
12
25
50
100
WEST AND CENTRAL BASIN SECTIONS
TRACES
Hi
Lo
Hi
Lo
Hi
Lo
DEHISSENCE OF OLD LEAF BLADES
SEED GERMINATION COMMENCES
RAPID GROWTH OF OLD PLANTS & NEW SEEDLINGS
POLLINATION & SEED PRODUCTION INITIATION
DEHISSENCE OF OLD LEAF BLADES
1
1A
2
3
3A
3B
8A
8B
7A
7B
7C
7D
6
6A
6B
5
5A
4A
4
4B
ZOSTERA MARINA
STANDING CROP IN GMS DRY WT/M² OF BOTTOM AREA

FIGURE A-21

A frequency polygon projection of the standing crop data for Ruppia maritima in Charlestown Pond, R. I. in 1961-63. These data demonstrate the quantitative seasonal growth and decline of this species.

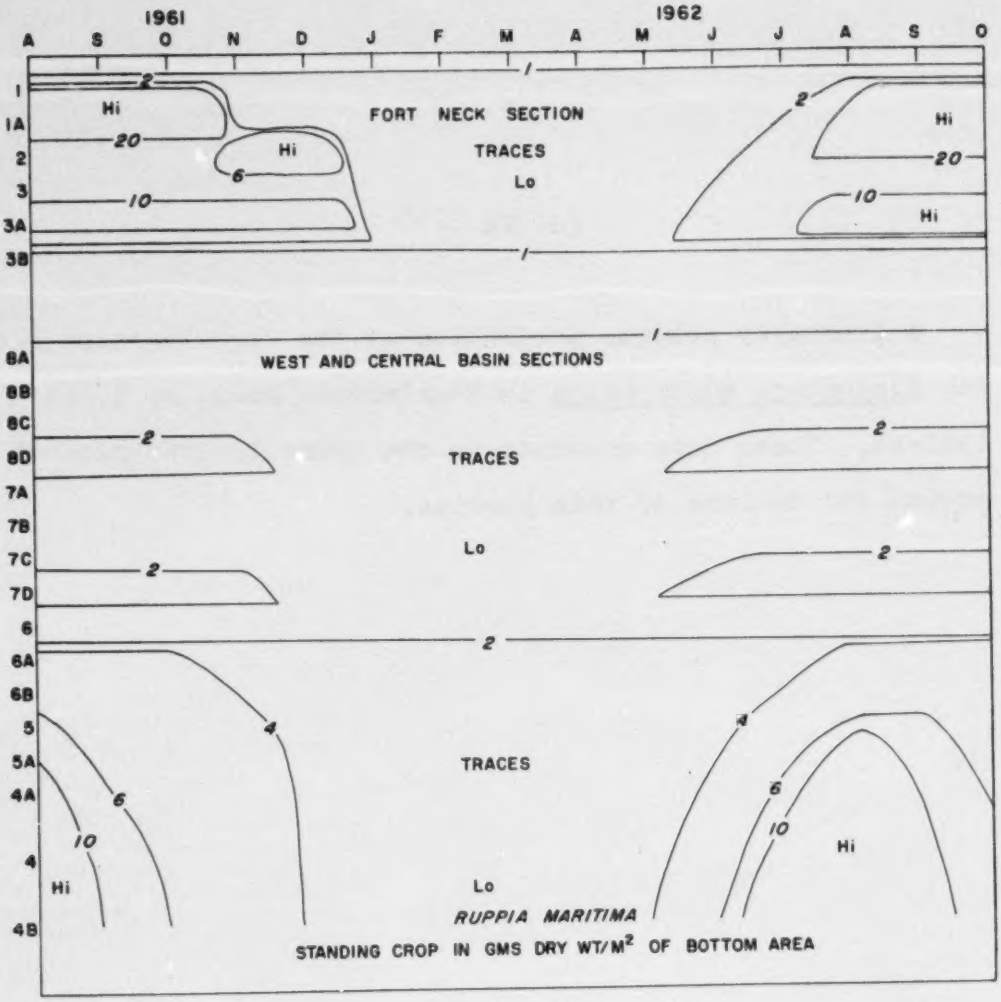

1961
1962
A S O N D J F M A M J J A S O
1
1A
2
3
3A
3B
8A
8B
8C
8D
7A
7B
7C
7D
6
6A
6B
5
5A
4A
4
4B
FORT NECK SECTION
TRACES
Lo
Hi
20
6
10
2
1
WEST AND CENTRAL BASIN SECTIONS
TRACES
Lo
2
TRACES
Lo
4
6
10
Hi
RUPPIA MARITIMA
STANDING CROP IN GMS DRY WT/M² OF BOTTOM AREA

FIGURE A-22

A frequency polygon projection of the standing crop data for Cladophora rudolphiana in Charlestown Pond, R. I. in 1961-63. These data demonstrate the quantitative seasonal growth and decline of this species.

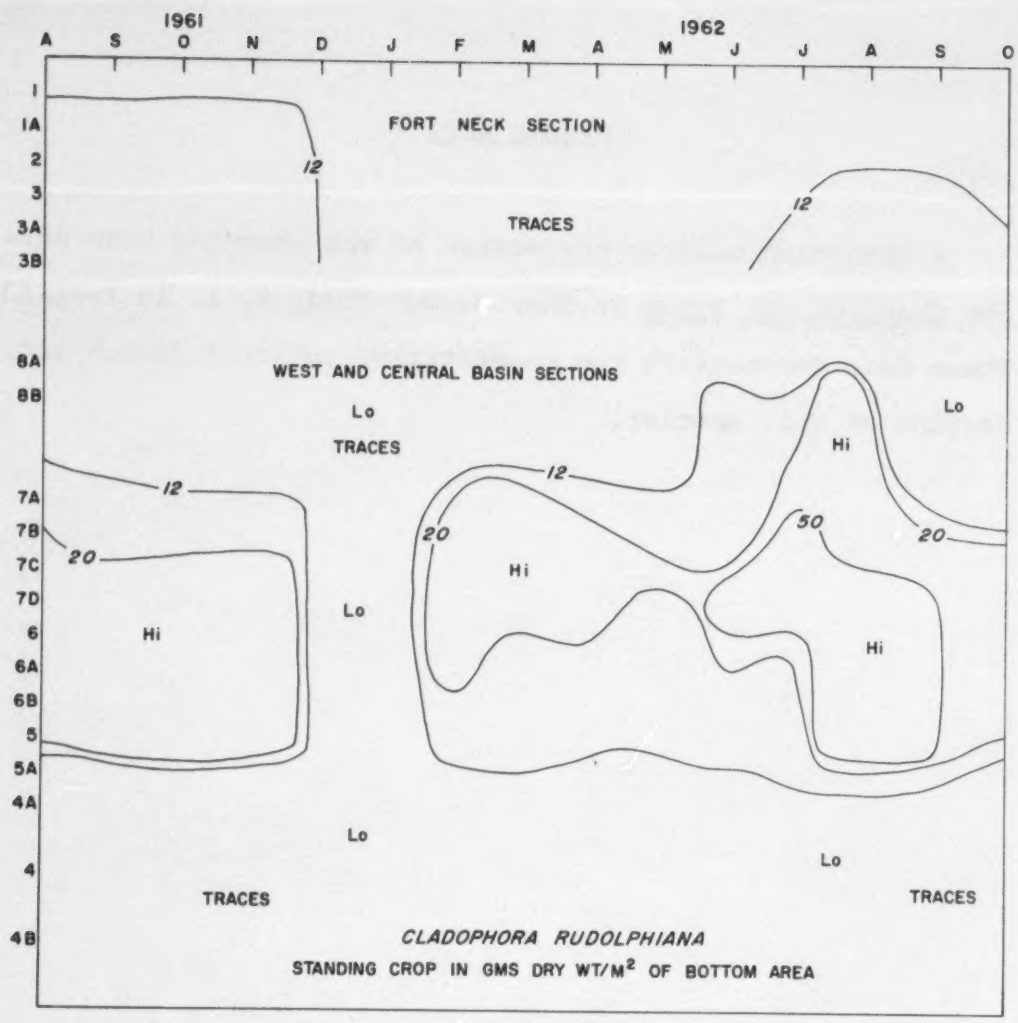

1961
1962
A S O N D J F M A M J J A S O
1
1A
2
3
3A
3B
8A
8B
7A
7B
7C
7D
6
6A
6B
5
5A
4A
4
4B
FORT NECK SECTION
12
TRACES
12
WEST AND CENTRAL BASIN SECTIONS
Lo
TRACES
Lo
Hi
12
20
Hi
Lo
12
20
50
20
Hi
Hi
Lo
Lo
TRACES
TRACES
CLADOPHORA RUDOLPHIANA
STANDING CROP IN GMS DRY WT/M2 OF BOTTOM AREA

FIGURE A-23

A frequency polygon projection of the standing crop data for Chaetomorpha linum in Charlestown Pond, R. I. in 1961-63. These data demonstrate the quantitative seasonal growth and decline of this species.

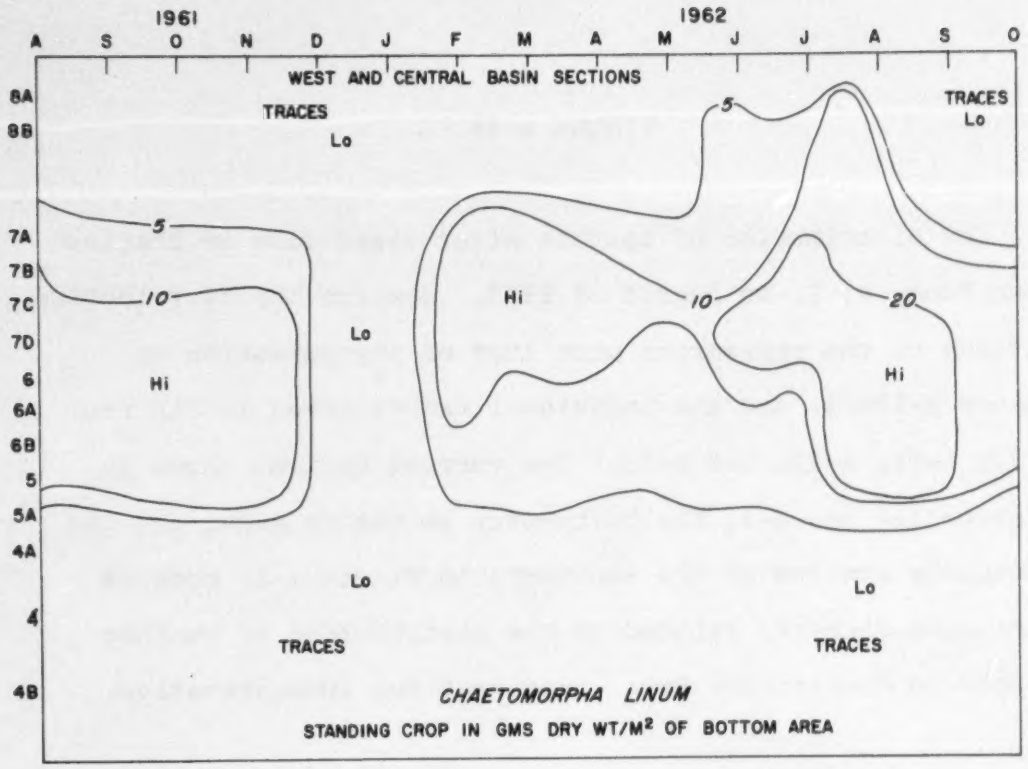
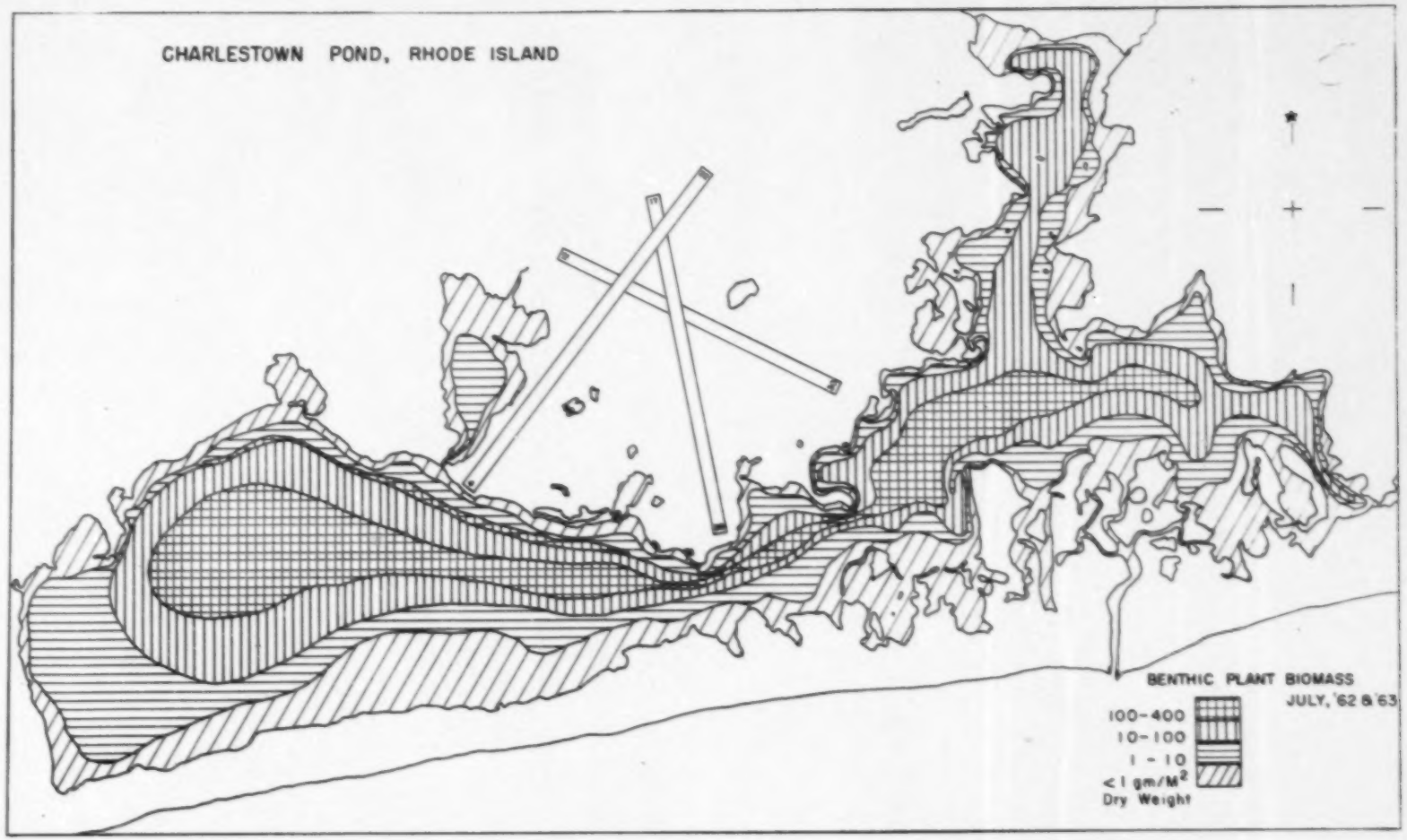

1961
1962
A S O N D J F M A M J J A S O
WEST AND CENTRAL BASIN SECTIONS
8A
8B
7A
7B
7C
7D
6
6A
6B
5
5A
4A
4
4B
TRACES
Lo
TRACES
Lo
5
10
Hi
Lo
Hi
5
10
20
Hi
Lo
Lo
TRACES
TRACES
CHAETOMORPHA LINUM
STANDING CROP IN GMS DRY WT/M² OF BOTTOM AREA

FIGURE A-24

The distribution of benthic plant vegetation in Charlestown Pond, R. I. in August of 1963. Compare the distribution pattern of the vegetation with that of phytoplankton in Figure A-19S/B, and the individual taxons given in Figures A-20, A-21, A-22, and A-23. The current regimes shown in Figures A-4 and A-5, the bathymetry in Figure A-24, and the phosphate content of the sediments in Figure A-18 provide variables directly related to the distribution of benthic plants in Charlestown Pond. See text for interpretation.


CHARLESTOWN POND, RHODE ISLAND
BENTHIC PLANT BIOMASS
JULY, '62 & '63
100-400
10-100
1 - 10
<1 gm/M²
Dry Weight